AMERICAN SPECIES OF ALECTORIA OCCURRING NORTH OF THE FIFTEENTH PARALLEL

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(WITH PLATES 41–47, CONTAINING 32 FIGURES)

While I have been pursuing an intensive study of *Usnea* and *Evernia,* the results of which have appeared in the Bulletin of the Torrey Botanical Club and the Botanical Gazette, I have also been collecting data for this review of *Alectoria.* The present paper therefore represents the work of over six years, which during the past winter I have brought into form for publication.

The genus *Alectoria* was proposed by Acharius in 1810, and was later limited by Nylander. Though Acharius included under his *Alectoria* several species now removed to other allied genera, his species cannot be considered "altogether incoherent," and the genus must be credited to him. Almost since its proposal, the question of spore-colors has led lichenologists to divide it into two taxonomic units. The argument of Tuckerman (Gen. Lich. 14–16. 1872) still holds undeniably true; while I also quite agree with Th. Fries (Lich. Scand. 19–28. 1871), and later Dr. Zahlbruckner, in the recognition of a sectional separation to distinguish species of *Alectoria* which are distinct in the number and color of their spores. Such a distinction is, however, better worthy of sectional than generic separation, and is adopted only to elucidate the problem of classification that presents itself. Stizenberger in a most valuable paper on the genus (Die Alectorienarten und ihre geographische Verbreitung, Annal. K. K. Nat. Hofmuseums, 7: 117–134. 1892) also recognized subgenera.

The following genera have included at various times species still considered in the genus *Alectoria,* though few of these names can be classed as true generic synonyms: *Lichen* L. 1753; *Usnea* Web. 1780; *Lobaria* Hoffm. 1795; *Parmelia* Ach. 1803; *Cornicularia* Ach. 1803; *Setaria* Ach. 1798, Mich. 1803; *Evernia* Fr.

1831; *Cetraria* Fr. 1831; *Bryopogon* Link 1833; *Atestia* Trevis. 1861; *Oropogon* Th. Fr. 1861; *Eualectoria* Th. Fr. 1871; and *Hyalospora, Hyalodidyma, Phaeospora* Sacc. 1882.

The genus is represented in our area throughout the Transitional and Boreal zones by at least ten distinct species.

Following each species I have appended a list of North American material examined. A large number of European specimens examined I have not thought necessary to list. To the curators of these herbaria I wish here to express my sincere thanks for the privilege of examination. The abbreviations within parentheses are used in the citation of specimens. In this practice I am following the excellent precedent set by Dr. L. W. Riddle in his recent work on the genus *Stereocaulon*.

1. Herbarium of the U. S. National Museum (NH).
2. Herbarium of Dr. J. W. Eckfeldt in the Academy of Natural Sciences, Philadelphia (ANS).
3. Herbarium of the New York Botanical Garden (NY).
4. Herbarium of Wellesley College, Massachusetts (W).
5. Herbarium of Prof. Bruce Fink, Miami University, Oxford, Ohio (F).
6. Herbarium of the Portland Society of Natural History, Maine (P).
7. The C. J. Sprague Herbarium in the Boston Society of Natural History(S).
8. The Clara E. Cummings Herbarium, Wellesley College (CEC).
9. Herbarium of the Boston Society Natural History (BSNH).
10. Herbarium of Dr. L. W. Riddle, Wellesley, Mass. (R).
11. Herbarium of the Sullivant Moss Chapter (SM).
12. Herbarium of the University of Maine, Orono, Maine (UM).
13. Taylor Herbarium, Boston Society of Natural History (T).
14. Herbarium of Dr. H. E. Hasse, Sawtelle, California (HEH).
15. Herbarium of Mr. C. C. Plitt, Baltimore, Md. (CCP).
16. Herbarium of the Carnegie Museum, Pittsburg, Pa. (CM).
17. Herbarium of Brown University, Providence, R. I. (B).
18. Herbarium of the Canadian Geological Survey, Ottawa (CGS).
19. Herbarium of Dr. A. C. Herre, Oakland, Cal. (ACH).

The author's herbarium in the Thoreau Museum of Natural History, Concord, Mass., is indicated by (H).

ALECTORIA:* Ach. pro. parte, Lich. Univ. 120. *pl. 13. f. 1–4.* 1810

"Tree-hair," "Rock-hair," "Horse-tail Lichen"

DESCRIPTION: *Apothecia* lateral, sessile, or on geniculations of the branches, appendiculate (*oregana*), scutelliform, convex, car-

* From the Greek, meaning unmarried.

tilaginous, innate-marginate, periphery entire, or fimbrio-ciliate (*oregana*), disk concolorous or discolorous, rarely pruinose. *Asci* clavate, containing 2 to 8 spores; paraphyses gelatinous, filamentous. *Spores* monoblast, hyaline or colorate, muriform or emuriform. *Spermagones* immersed or papilliform, apices slightly incrassate. *Soralia** white, pale virescent or yellow. *Soredia* unobserved. *Cephalodia* unobserved. *Cyphella* occasionally present. *Thallus* erect, prostrate, or pendulous, branched, tortulous, terete, subterete, or compressed; glabrous, nitidous, canescent, sulciform or foveolate; pale stramineous, virescent sulphureous, cinereous or brown; *cortex* cartilaginous, contiguous; gonidia *"Protococcus"* (*Cystococcus humicola* (Næg.); medulla loosely cottonous, arachnoid or absent.

Though I have examined an immense amount of material and placed it under the following species with as much accuracy as possible, judging it with the enlightenment of a long and critical study, I am not ready to claim that the distribution of specimens has been either faultless or the reason always apparent. The genus *Alectoria* presents a most complex and difficult problem, due to the enormous variation found in filamentous lichens, and, after years of study, it seems to me that we must keep the broadest view of species and allow the two extremes of variation to stand far apart. To narrow our limits, and name contingent phases that present themselves in legion, we at once destroy the discrimination which is possible to one after long study of much material.

The only determinations that I am absolutely sure of are of those specimens which I myself have gathered in the field, or that have been collected in such entirety, accompanied by careful field notes, that I can not only judge of the plant, but of its particular environs. It is a common experience of lichenists to find that a plant which has long been an absolute puzzle after the examination of much herbarium material, will be at once understood if met and studied in the field. *Alectoria divergens* with *Cetraria aculeata, Alectoria chalybeiformis* and its northern limit of distribution, and *Alectoria ochroleuca cincinnati* and *crinalis,* are examples of puzzles that only an extensive field study can thoroughly solve. Exactitude can never be gained by narrowing

* Bitter, Hedwigia **40**: 171. 1901.

the limits of variation in this genus, and I take it that to make possible a scientific comprehension of species is one aim of systematic botany.

KEY TO THE SPECIES

A. Thallus dark (brown) throughout.
  a. Prostrate.
    Rigid.
      Unicolored. [boreal
        Stout, apices furcate, esoraliate.....*divergens*]
      Unicolored or partially bicolored. [austral to subboreal
        Stout, apices simple, soraliate.....*chalybeiformis*]
    Subrigid.
      Bicolored. [subboreal to boreal
        Slender, apices simple, esoraliate.....*bicolor*]
  b. Pendulous.
    Lax.
      Unicolored.
        Slender throughout. [transitional to subboreal
          White soraliate .....*implexa*]
        Stout, extremities capillaceous.
          White soraliate.
            Apothecial margins entire. [transitional
              Disk brown .....*jubata*]
            Apothecial margins ciliate. [alpine
              Disk brown .....*oregana*]
          Yellow soraliate.
            Apothecial margins entire. [transitional to subboreal
              Disk yellow. .....*Fremontii*]
B. Thallus light (virescent) or partially so.
  a. Erect.
    Rigid.
      Unicolored. [alpine
        Slender, apices minute .....*osteina*]
      Bicolored, darker above. [boreal
        Slender, apices livid .....*nigricans*]
        [boreal
        Stout, apices black .....*ochroleuca*]
  b. Prostrate.
    Rigid.
      Unicolored, occasionally blackening throughout.
        Stout, cavernous. [boreal
          Extremities noncapillaceous .....*cincinnati*]
  c. Pendulous.
    Subrigid.
      Unicolored.
        Slender, esulciform.
          Extremities subcapillaceous. [transitional

Sulphurous .....*virens*]
Stout, occasionally sulciform.
Extremities capillaceous. [transitional to subboreal
Virescent .....*sarmentosa*]

SECT. I. BRYOPOGON (Link) Th. Fries, Lich. Scand. 23. 1871

Asci containing 8 hyaline spores. Thallus dark or light. Medulla cottonous.

In 1859, Tuckerman described (Amer. Jour. Sci. & Arts, **28**: 203) a new *Cetraria* from California which he named after the State. This plant has been the object of much discussion, and as in the Bryologist (**13**: 28. 1910), during the past year, it was definitely attributed by Mr. G. K. Merrill to the genus *Alectoria,* we must consider it in the present paper. Let us follow its history chronologically. The plant was collected at Monterey by Menzies, and specimens were given to Tuckerman. The type material is in the Tuckerman Herbarium, Botanic Museum, Harvard University, Cambridge, Mass. Tuckerman's original description was as follow: "thallo caespitoso cartilagineo anguloso lacunoso-subcanaliculato opaco e viridi fusciscente ramis irregulariter subdichotome ramosis patentibus, fertilibus superne incrassatis; apotheciis terminalibus appendiculatis margine dentato-fimbriatis demum convexis nigris." This latter was translated by Mr. Merrill (Bryologist, l. c.), but he inadvertently failed to render "anguloso." Tuckerman added to his original description: "Fronds in small, roundish masses, many branches diverging from a single base, with the aspect rather of a small slender state of *Ramalina calicaris, β,* than of the erect *Cetrariae,* to which, and in particular *C. tristis* and *C. aculeata,* it is indeed, if I mistake not, nearest allied. The station, upon trees, and on the coast of California, is a very unlikely one for *C. aculeata,* from which the present also differs remarkably in habit of growth, and in color. Though more than seventy years have passed since the venerable botanist who gave me these specimens collected them, they appear to be undescribed."

In 1858–60 (Synop. Lich. 300), Nylander makes the next important reference to the species in a footnote under *C. aculeata* Fr. where he writes: "(1) Forte varietati *horrescenti* Nyl. Prod. p. 194 affinis sit *Cetraria californica* Tuck. Suppl. 2, p. 203, 'thallo

. . . nigris.' Ad corticem arborum in Monterey Californiae (Menzies). Specimen nullum vidi, et sine analysi dubium est an hujus sit loci species Tuckermaniana. Apothecia 'appendiculata' nigra genus aliud indigitare videntur."

In 1872 (Gen. Lich. 9), Tuckerman writes "*C. californica,* Tuckerm." . . . "a tree-lichen, discovered by Menzies, and looking often rather like a discoloured, small form of *Ramalina calicaris,* but in fact comparable, as respects the thallus, with *Cetraria aculeata,* and, especially as respects the apothecia, with *C. tristis,* proves also to agree with the latter in its spermogones and spermatia; and constitutes therefore a very interesting addition to our scanty material for the final determination of the place of *C. tristis.*"

After ten years, in 1882 (Synop. 29), Tuckerman again lists the species, describing it as follows: "thallus tufted, fruticulose, erect, cartilagineous, subfistulous, compressed-terete, at length deeply- and canaliculate-lacunose dichotomously much- and spread-branched; greenish olivaceous, fuscescent, dull; apothecia sub-terminal, middling-sized, appendiculate, the disk dark-green, becoming convex and black, and excluding the toothed margin. Spores ellipsoid $\frac{6-9}{3-4}$ mic.—Spermogones immersed-papillae-form; spermatia oblong, thickened at each end $\frac{4-5}{1-1\frac{1}{2}}$ mic." It will be noticed that the most important additions are the words "compressed-terete." He writes also "Fences, Oregon, *Hall.* British Columbia, *Macoun.* Most naturally associable with the genus which shall include *C. aculeata;* but agreeing in the spermogones and their contents with *C. tristis.*"

In 1888, Nylander received from Dr. J. W. Eckfeldt* actual material collected on *Pinus contorta* in Oregon and described it as a new species (Enum. Lich. Freti. Behringii, Bull. Soc. Linn. Normandie, Caen 1: (4) 270) of *Alectoria* as *A. cetrariza.* His specific name curiously enough hinted at Tuckerman's original generic distribution, as we now realize that he was renaming the Menzies' plant, though, so far as we know, he did not recognize it as the plant fitting Tuckerman's description which he had quoted. Nylander described it as follows: "Thallus castaneo-

* Topotype No. 44, Eckfeldt herbarium, Acad. Nat. Sci. Phila.

fuscescens subcompressus ramosus erectus (altit. circiter 2 centimetr.); apothecia badio-nigricantia (latit. 2–3 millim.), terminalia; spores 8 nae ellipsoideae minutae, longit. 0.005–8 millim., crassit. 0.0025–35 millim. Iodo gelatina hymenialis fulvescens. Super *Pinus contortam* in Oregon, Tellanock (misit Dr. Eckfeldt). Comparanda cum *A. divergencente,* quae thallum habet teretiusculum, sporas majores. Thallus lamina tenuit rubescens. Spermatia bifusiformia, longit. 0.0045 millim., crassit. 0.0005 millim.; sterigmata breviuscula."

In 1891 (Bull. Torr. Bot. Club **18**: 257. 1891), Dr. Eckfeldt writes under Botanical Notes: "*Alectoria cetrariza* (Nyl.) Eckfeldt. Thallus erect, tufted, caespitose and spreading, slender, softish, at first compressed; lacunose and channeled beneath, the branches becoming terete; terminating in subulate extremities, olivaceous to lead color and darkening, canescent.

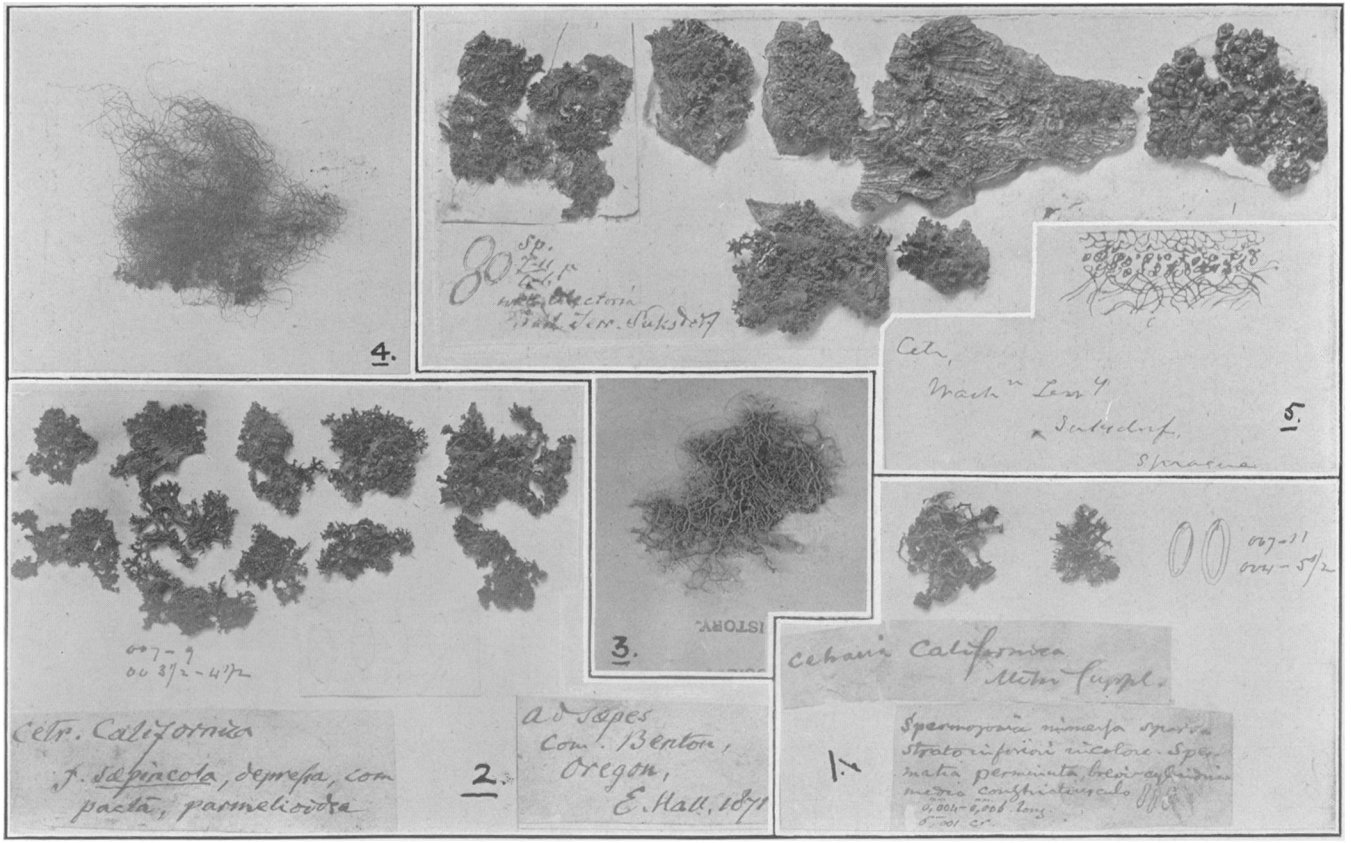
"Apothecia of middling size terminal and subterminal, lead-colored, margin uneven, dentate or disappearing, becoming deflexed with a thin bloom. Spores ovoid-ellipsoid, hyaline continuous, quite constantly $\frac{6-7}{3-3\frac{1}{2}}$ mic.

"This lichen was first discovered by Mr. Thomas Howell, in October [30], 1882, on the branches of small shrubs, bordering the sea, at Tillamook, Oregon. From its resemblance and relationship to the well-known *Cetraria californica,* Tuck., no doubt this interesting plant has been collected before, and distributed under an erroneous name. It is evident that this lichen is peculiar only to the northwestern coast."

During the years covered from 1894 to 1903, three sets of exsiccati were issued including specimens of *Cetraria californica* Tuck., *i. e.,* Hasse, No. 192, San Gabriel mts., Cal., Aug., 1896; Cummings, Lich. Bor. Amer. No. 142; Decades No. Amer. Lich. No. 212, Wawona, Cal., May 16, 1896, 3,950 ft.; Zahlbruckner, Kryptogamae Exsiccati, San Jacinto mts., Cal.*

In 1910, Mr. Merrill (Bryologist, l. c.) reviews the history of the plant somewhat vaguely, and makes these important statements: (1) that he had noticed a "discrepancy between the original description" . . . "and the published examples"; (2) that

* See also Herre: Proc. Wash. Acad. of Sciences **7**: 337. 1906 and **12**: 206. 1910.



SPECIES OF ALECTORIA AND CETRARIA

"compressed-terete is scarcely applicable to any condition shown" in his specimens of the above exsiccati; (3) that the above exsiccati specimens are represented in the "Herb. Tuckerman" as "var. *sepincola*"; (4) that the "terete-compressed form" sent him by Mr. A. S. Foster "is really *C. californica* of Herb. Tuckerman," fide Farlow; (5) that in Tuckerman's species the apothecia are "typically *lateral* and affixed in much the same manner of *Ramalina* (*Alectoria*) *gracilis* Nyl. and appendiculate when only one occurs on a stem," etc.; (6) that Nylander's *Alectoria cetrariza* of Eckfeldt is the same plant; (7) that accepting Nylander's view of the generic affinity he proposes the new combination *Alectoria californica* (Tuck.) Merrill; (8) that *Cetraria californica* var. *sepincola* of the Tuckerman herbarium is not "related with *Alectoria californica*" (Tuck.) Merrill; (9) that in the latter plant the thallus is "cylindrical, radial in structure, the apothecia lateral with a commonly entire and smooth margin"; and (10) that *Cetraria californica* Tuck. as represented in the published exsiccati is still undescribed.

We now have, I believe, all the published facts for our consideration. There seems no doubt that Tuckerman fully considered the affinities of the plant he described, and that now reposes in his herbarium. For twenty-three years he found nothing to cause him to change his original distribution. He nevertheless noticed an affinity with the bilocular-spored *Ramalinas* as well as the *Cetrarias*.

Nylander, until he received Dr. Eckfeldt's plant, agreed doubtfully with Tuckerman, and in naming the former's plant showed that he realized a *Cetrarian* affinity by the choice of a specific name.

Dr. Eckfeldt simply proclaimed the work of Nylander, enclosing without reason Nylander's own name in parenthesis.

As it seems probable that the exsiccati distributions were of an unnamed species or variety erroneously determined, we may drop them for the present from our consideration (see *pl. 41*).

Mr. Merrill calls attention to a similarity with *Ramalina gracilis* Nyl., and refers also to a similarity with *Alectoria oregana* Nyl. ex Tuck.

Now, to return to Tuckerman's interpretation of the plant's

structure. The two important considerations lie in the exact cross-sectional structure, not alone form, of the thalline branches, and the position and form of the apothecia. His first (1859) description gives us no account of the former, but calls the latter terminal, appendiculate, margins toothed fimbriate. In 1872 he adds nothing except an account of the spermogones and spermatia. In 1882 he calls the branches "compressed terete"; the apothecia "subterminal . . . appendiculate," the margins disappearing.

Nylander's first (1887) description of the actual plant was of the Eckfeldt specimen whose branches he termed subcompressed; the apothecia he called terminal.

Dr. Eckfeldt himself in 1891 calls the branches "at first compressed . . . becoming terete"; the apothecia "terminal and subterminal," "margins uneven, dentate or disappearing."

Stizenberger in 1892 quotes in litt. from Nylander "Thallus lamina tenui submicroscopio iodio rubens," l. c. 126.

Dr. Herre's descriptions seem composite in the present light (Proc. Wash. Acad Sci. l. c.).

Lastly, Mr. Merrill first states that "compressed-terete" is scarcely applicable, and later inconsistently terms his Foster material "terete-compressed"; in summing up, he later calls the branches "cylindrical, radial in structure." The apothecia he first calls "typically *lateral*" and "appendiculate when only one occurs on a stem, or the uppermost when more than one is found," later he finds them simply "lateral with a commonly entire and smooth margin."

I believe that any one examining material of this plant or No. 82 of Mr. Merrill's "Lichenes Exsiccati" will find the following characteristics true. They will agree with Tuckerman and Nylander that the branches are "compressed-terete," though sulcate (="subcanaliculato," "subfistulous," Tuck.); the apothecia, terminal and subterminal, appendiculate, disk convex, becoming recurved, emarginate, periphery entire, toothed or at length lacerate,—these latter varying conditions due directly to extent of growth. The medulla is densely stupose.

In the National herbarium are the plants here figured in plate 41, which are confirmative of Dr. Farlow's findings in the Tucker-

man herbarium, though a more reduced form is also discovered, *i. e., stygiodes,* not mentioned in Mr. Merrill's paper. I have also examined the Eckfeldt topotype in the Academy of Natural Sciences at Philadelphia, and with it the specimen sent Dr. Eckfeldt by Mr. Merrill for comparison.

If we are to consider this plant an *Alectoria,* as the genus has been commonly understood, we must find the branches structurally cylindrical (=terete), compressed at the axils or along the larger branches; the apothecia lateral, rarely appendiculate (when borne on the short undeveloped branches of *oregana*), generally innate-marginate, margins entire, at length suppressed or fimbriate (*oregana*); the medulla stupose, arachnoid or wanting; the spermogones and spermatia are hardly diagnostic enough for serious consideration among the genera of Usneaceae and *Cetraria.*

I cannot admit of the above diagnostic characters for the plant under consideration though for the most part they are applicable in a loose way. The branches are not truly* cylindrical, the apothecia occasionally appendiculate, the medulla is distinctly dense. If the idea of radial structure is made to include such plants as the one we are considering, we must allow ourselves besides, almost unlimited latitude as to the position of apothecia, even if we waive the margination as in any way diagnostic. The margins within a genus are of course admittedly variable,—the genus *Evernia* has its pseudo-ciliate member in *vulpina; Alectoria* in *oregana,* and the ciliate species of *Usnea* an almost eciliate member in *trichodea.*

Mr. Merrill has remarked on the similarity between *californica* and the thicker, shorter, undeveloped branches of *oregana,* and in a comparison of the short, caespitose branches of the latter plant with *californica* it is admitted a similarity will be noticed. It would seem therefore that the filamentous portions of *oregana* bridge the transitional gap between the pendulous species, and a fertile caespitose condition seen in part in *Alectoria oregana.* As already has been said, and what is also true of the *Usneas,* the caespitose plants are more commonly fertile, and this is true of

* Due to frequency of fistulas, the circular distribution of gonidia is rarely complete.

the caespitose branches of *oregana,* for its filiform branches are generally sterile. No *Alectoria* except *oregana* has been known with other than an innate marginate condition of the apothecia, —in *oregana* it is fimbrio-ciliate.

Now that we have finished the structural considerations, let us turn to the actual material at hand and its distribution. An examination shows clearly that it varies enormously, passing insensibly from reduced degenerate examples (*i. e., stygiodes*), through specimens with broad or narrow lacinia, and finally to those in the subterete condition which are typical of Tuckerman's true *californica.* Tuckerman himself clearly realized the intergradation, for he gave the broad laciniate, rarely canescent examples the name *sepincola.* The littoral and low country examples from central California northward to Washington always approach or are referable to the canescent subterete species, while the specimens from the mountains of California (4000 ft.) to Mt. Benson, Vancouver (3,300 ft.) are referable to the variety *sepincola,* the name first given by Tuckerman to such specimens, for which I propose *Tuckermanii,** as *sepincola* (*Cetraria saepincola* (Ehrh.) Ach. is already in use in the genus, which would cause confusion if this variety were ever raised to a species. As all Tuckerman's material came from a coast (an intermediate) station in southern California the type of the subterete species is not as typical as those specimens from further north, nor are the examples of the compressed variety as robust as those from higher altitudes. For this reason I have not used the Menzies material for the type specimen. *Cetraria californica Tuckermanii* should be used for the plants of the published exsiccati, excluding Mr. Merrill's distribution under *Alectoria californica* (Tuck.) Merrill. His distribution represents typical *Cetraria californica* Tuck.

Cetraria californica Merrill, proposed by Mr. Merrill, would have been a homonym if Mr. Merrill's inference had been cor-

* Type No. 2013 author's herb. No. 142 Lich. Bor. Amer. Wawona, Cal., 3950 ft. alt., May 16, 1896, leg. C. E. Cummings. Thallus caespitosus, laciniis fuscis supra, pallidioribus infra, compressis, angustis vel latis, lacunosis, quorum apices digitati, subdichotomi. Apothecia terminalia vel subterminalia, margine crenulato-dentato, disco nigro-fusco. Sporae 3–5 × 6–10μ. Habitat in variis arboribus.

rect. His inference and Nylander's was based no doubt on insufficient material, which in this case easily leads one astray.

SPECIMENS EXAMINED

OREGON: Benton Co., *E. Hall,* 1871 (NH); Tillamook, *T. Howell,* Oct. 30, 1882 (ANS); Dalles, *J. W. Eckfeldt,* 1880 (74 CGS). WASHINGTON: Westport, no. 82 Lich. Exsic. *Merrill, A. S. Foster,* Jan. 25, 1908 (6304 F). BRITISH COLUMBIA: Mt. Benson, 3,300 ft., Vancouver, *Macoun,* July 10, 1892 (CGS); Kootanay Lake, 5,000 ft., *Macoun,* July 9, 1890 (CGS). CALIFORNIA: San Gabriel mts., *H. E. Hasse,* Aug., 1896 (Hasse distribution); Wawona, *C. E. Cummings,* May 16, 1896 (No. 212 Decade No. Amer. Lich. and No. 142 Lich. Bor. Amer.); San Jacinto mts. (Krypt. Exsic. Zahl.); Stanford, 400 ft., *A. C. Herre,* Oct. 1, 1903 (ACH); Mt. View Landing, *A. C. Herre,* Sept. 30, 1903 (ACH); Alpine creek cañon, 2,000 ft., *A. C. Herre,* Apr. 5, 1905 (ACH); Waddell creek, 1,400 ft., *A. C. Herre,* June 29, 1906 (ACH).

ALECTORIA DIVERGENS (Ach.) Nyl. Synop. Lich. 278. 1858–60

Cornicularia divergens Ach. l. c.

TYPE: not indicated, but the specimen on which the species was based is in the Acharian herbarium, Universitetets Botaniska Institution, Helsingfors, fide Prof. Dr. F. Elfving.

TYPE LOCALITY: "alpibus Lapponicis. Wahlenberg."

ORIGINAL DESCRIPTION: "thallo cartilagineo effuso subcaespitoso glabro fusco-castaneo, ramis compressiusculis subangulosis scabriusculis elongatis laxis divergentibus flexuosis dichotomis attenuatis, apice longe furcellatis curvatis. (Apothecia ignota.)" Meth. Lich. 2: 303. 1803.

FIGURE: Acharius, Meth. Lich. l. c. *pl. 6. f. 1.*

DIAGNOSIS: *Thallus chestnut*-brown, caespitose, filamentous, stout, rigid, *apices furcate.*

DESCRIPTION: *Thallus* caespitose or procumbent, filamentous, stout, rigid, chestnut-brown, branches subterete; *cortex* glabrous, or generally nitidous, often rimulose, exposing white medulla; *primary branches* dichotomous, subdivaricate (max. length 14 cm.); *secondary branches* dichotomous, divaricate; *fibrils* flexuous, furcate. *Apothecia* lateral medium sized (max. diam. 9

mm.), convex, crenulate—marginate, disk chestnut. *Spores* 8–10 × 4.5–5.5μ.

SUBSTRATA: on earth.

GEOGRAPHICAL DISTRIBUTION: Common throughout the Boreal zone. It has been reported from Newfoundland (*Eckfeldt and others*) to Greenland (*Vahl*) on the Atlantic coast, and from Oregon (*Roell*) to Alaska (*Cummings* and *others*) on the Pacific coast. In addition to these localities I have seen specimens from Melville island, Keewatin and Ungava and it has been recorded from Hudson bay (*Bell, Macoun*), Great Bear lake (*Leighton*), and Arctic America (*Richardson*).

OBSERVATIONS: There is little doubt that this species holds a very close relation with the Cetrarias. It is often misdetermined for *Cetraria aculeata* (Screb.) Fr., and in its most luxuriant state resembles not only in color but in structure the true *Cetrarias*. The spore characters have also been described differently by authoritative authors, those here given are compiled from Nylander, Tuckerman, and Crombie who all no doubt gleaned their information from the same source, *i. e.,* specimens from the islands of northeastern Asia.* Nylander at first called the asci "bi-tri-sporae,"† but later Nylander, Crombie and Dr. Zahlbruckner include it under the Section *Bryopogon* to which they attribute 8 spores in an ascus.‡ The size and form of the apothecia is more typical of *Cetraria* than *Alectoria*. There seems little question that this species "Affinitatem magnam praebe[n]t cum *Cetrariis*."

SPECIMENS EXAMINED

NORTH AMERICA: *Drummond* (S). NEWFOUNDLAND: Long Island, *A. C. Waghorne,* Sept. 9, 1893 (NH); *W. Palmer,* Aug., 1887 (NH). LABRADOR: Pack's Harbor, *J. W. Eckfeldt,* 1892–96 (NY, NH); L'ance au Loup, *J. W. Eckfeldt,* 1892–96 (NH, NY); Blanc Sablon, *J. W. Eckfeldt,* 1892–96 (NH); Red Bay, *A. C. Waghorne,* June 8, 1899 (NH); Long Island, *A. C. Wag-*

* Arnold: "mit Apothecien auf Neufundland gesammalt." Lich. Fragm. Oesterr. bot. Ztschr. **46**: 11. 1896.

† Synop. 279. 1858–60, also Notis. ur Sällsk. Fauna et Fl. Fenn. **8**: 112. 1882.

‡ Nyl., Bull. Soc. Linn. Norm. Coen. **1**: (4). 268. 1888: "sporae 8 nae."

horne (CEC); Clearwater Lake, *A. P. Low,* July 12, 1896 (CGS). GREENLAND: Rukstanseek, *Vahl* (NY); Holstensbory, *Th. Holm,* Aug., 1886 (ANS); Christianshaab (NH); ?, *G. Edeling,* 1896 (1,278 CM). UNGAVA: Diggs Island, *R. Bell,* Sept. 15, 1884 (CGS). BRITISH COLUMBIA: Vancouver Island, *J. Macoun,* May 17, 1893 (NY); Parson's Mt., *J. Macoun,* May 17, 1893 (CEC, 3,174 F). ALASKA: Pt. Barrow (NH); St. Michael's, *W. A. Setchell,* July 19, 1899 (NH); Seward Pen., *A. J. Collier,* 1900 (NH); Cape Nome, *W. A. Setchell,* July, 1899 (CEC); St. Michael's, *S. M. Turner,* Sept., 1875 (CEC); Hall Island; *W. Trelease,* July 14, 1899 (CEC); Kadiak Island, *W. Trelease,* July 21, 1899 (CEC); Bering St., *C. Wright,* 1853 (NH). YUKON: near Dawson, *R. S. Williams,* Apr. 2, 1899 (1860 H). FRANKLIN: Melville Island, *E. Parry* (S). KEEWATIN: *J. W. Tyrrell,* July 28, 1893 (CGS).

ALECTORIA CHALYBEIFORMIS (L.) S. F. Gray, Nat. Arr. Brit. Pl. 1: 408. 1821

Lichen chalybeiformis L. l. c.

TYPE: Species is based on *Usnea rigida horsum,* etc., of Dillenius; the Dillenian specimen, "Infertile," is in the Dillenian herbarium, Botanic Gardens, Oxford, England, and is *Alectoria jubata,* var. *chalybeiformis* (L.) fide Crombie. In the Linnaean herbarium, "*Lichen chalybeiformis* (886) = *Alectoria chalybeiformis* Wainio, Adj. I, p. 115, status thallo paululum vel sat implexo fusco—vel olivaceo-nigricante (*Alect. prolixa* var. *chalybeiformis* Auct.) fide *Wainio.*

TYPE LOCALITY: "Europa."

ORIGINAL DESCRIPTION: "filamentosus subramosus decumbens implicato-flexuosus," L. Sp. Pl. 2: 1155. 1753.

FIGURES: [Dill. Hist. Musc. *pl. 13. f. 10.* 1741.] Oeder, Fl. Dan. 2: *pl. 262.* 1766.

DIAGNOSIS: *Thallus* caespitose, brown, branches flexuous, *wiry* terete, often spinulose, and generally *abundantly ruptured* with *white soralia.*

DESCRIPTION: *Thallus* caespitose, precumbent or rarely subpendulous, filamentous, wiry, terete to subterete, often spinulose, dark to light brown; *cortex* glabrous or nitidous, occasion-

ally rimulose, often abundantly ruptured with white soralia; *primary branches* flexuous, dichotomous, divaricate, axils occasionally compressed (max. length 12 cm.); *secondary branches* dichotomous; *fibrils* short. *Apothecia* unobserved.

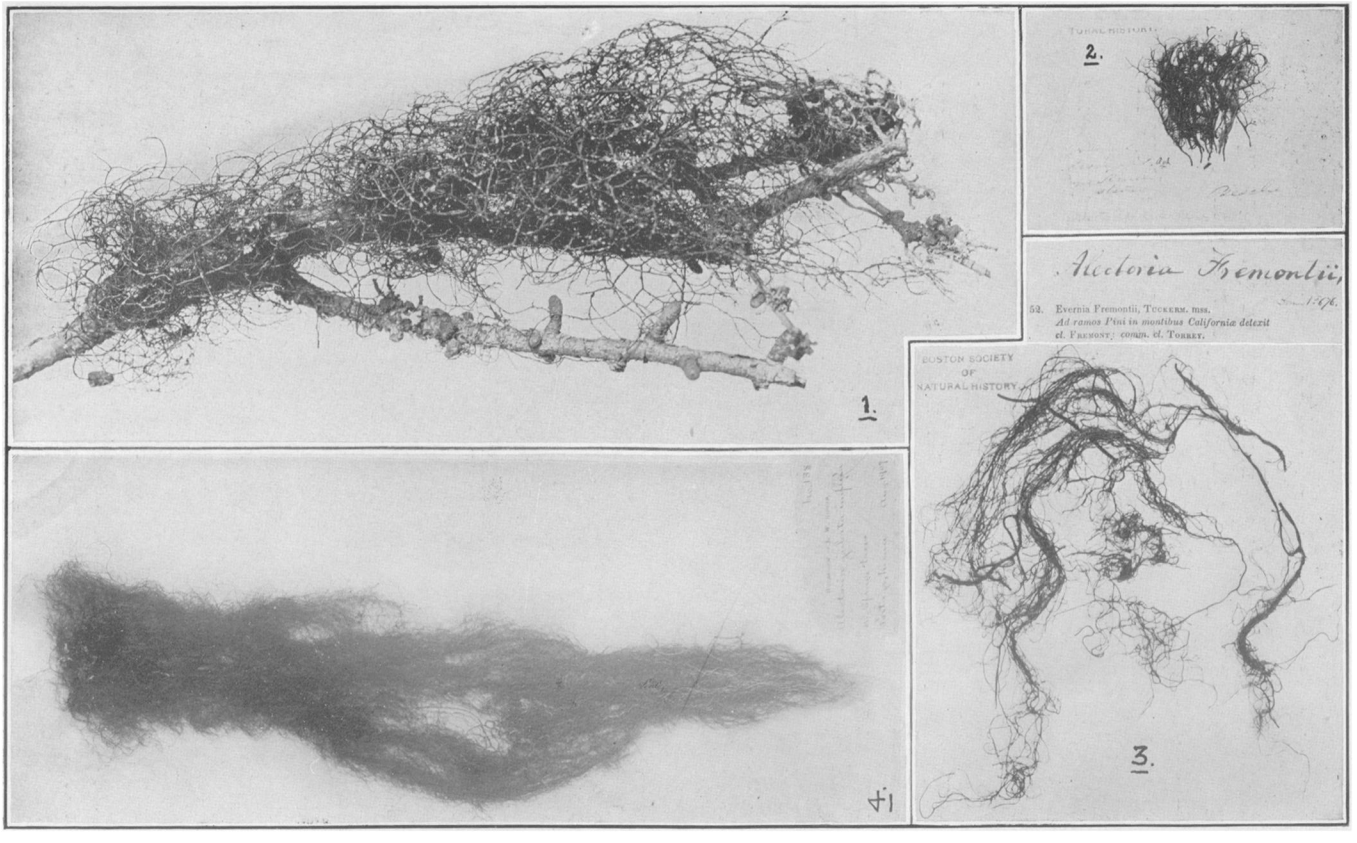
CONTINGENT PHASES: (*a*) yellowish-brown. (*b*) proximal portions black.

SUBSTRATA: On living and dead trees, on old fence rails, and occasionally on moss and humus covered rocks.

GEOGRAPHICAL DISTRIBUTION: Common throughout the Transition and Boreal zones, occurring sparingly in the upper Austral. It is recorded from Oregon (*Roell*), British Columbia (*Macoun*) to Alaska (*Cummings*) in the west, and occurs from Virginia and Maryland to Labrador (*Eckfeldt*) in the east. It occurs in the middle states from Iowa, Illinois (*Fink*), and Minnesota (*Fink*) northward to Great Bear lake (*Richardson, Leighton*) and Greenland (*Vahl, Macoun*). It is also found commonly in the Boreal swamps of the upper Austral zone.

OBSERVATIONS: This plant, which, according to Crombie has never been found bearing apothecia,* is distinguished by its wiry, rigid thallus. Its branches in most specimens are spinulose and largely ruptured with white soralia. Though I have examined a great many specimens I have never seen a fertile plant, yet Tuckerman records it as follows: "White Mountain, fertile, *Lesquereux;* as also on branches of firs in cold swamps, where equally fertile"; Dr. Farlow informs me, however, that at present no fertile specimen is in the Tuckerman herbarium collected by Lesquereux. It has been argued (*Fink*) that in the absence of apothecia it should be kept as a variety of *jubata,* and if it had not already been raised be Gray, Nylander, Wainio, and Norrlin to specific rank I would hesitate to do so. The generally caespitose and wiry thallus seem sufficient grounds for recognizing it as a species, for it certainly shows little intergradation with the pliant and pendulous *jubata* or the more lax and pendulous *implexa.* It does not seem likely that *jubata* is another condition of growth of this same plant, but rather more probable that it is not as yet known in a fertile state. To grant this, however, we must believe such an experienced and careful a worker as Tuckerman at fault.

* Lightfoot, Fl. Scot. 892. 1777, records it fruited.



SPECIES OF ALECTORIA

In regard to its distribution, it is quite likely that some of the northernmost records above cited may be erroneous, and refer in reality to the species that follows, which it resembles distinctly more than *jubata* or *implexa*. In point of fact the one specimen (NY) I have seen of *A. bicolor Berengeriana* Mass., suggests a close *chalybeiformis* relationship. As I have studied these plants it has frequently crossed my mind that *bicolor* might someday prove to be the fertile state of *chalybeiformis*. The latter is not uncommonly found with blackened basal portions, (the two, in fact, are plainly much alike in color) and its more boreal distribution is compatible with this idea. I have also wondered whether this theory did not perhaps explain the Tuckerman statement. So far as the chemical tests of Nylander and Crombie have weight, it is also suggestive that *chalybeiformis* and *bicolor* were given the same reaction, distinguishing the two from the rest of the *jubata* group. Just as *hirta* is the sterile, but sorediate condition of *Usnea florida* (L.) Web., may not *chalybeiformis* be the soraliate (more rigid) condition of *bicolor?* With more material of the latter plant for study, I hope to be able to ultimately reach a decision of this now circumstantial, yet I feel perhaps not improbable view.

NOTE: *Alectoria jubata lanestris* Ach. Lich. Univ. 593. 1810. Reported from Oregon (*Roell*), Flora, **72**: 262. 1889, and in Newfoundland by Stizenberger, l. c. 129. I have not seen this form and cannot judge of its importance, it was described as follows "lorulis ramisque prostratis tenerrimis mollissimis implicatis atris opacis. Habitat in ramis arborum Helvetiae."

Alectoria nidulifera Nyl. ex Norrl. Flora **33**: 8. 1875. Reported from Miquelon island by Arnold (Flora **71**: 82. 1888). According to Tuckerman, this species is not separable from *Alectoria chalybeiformis* (see however Bryologist, **14**: 37. 1911). The original description is as follows: "Thallus olivaceo-spadiceus erectus minusculus (1–2-pollicaris, crassitie basi circiter 0.5 millim.), patenti-ramosus, sat dense arbusculiformis, ramis subflexuosis, passim sorediosus, sorediis albidis non prominulis, saepius propagula erectula emittentibus indeque spinulosis. Supra truncos pini in Findlandia media frequens (Norrlin)."

Alectoria (Bryopogon) jubata y. nitidula Th. Fr. Lich. Arctoi.

26. 1860 and Lich. Scand. 25. 1871. This variety has lately been included by Mr. Merrill as a North American plant (Bryol. l. c.). I have seen one specimen that seems perhaps referable to it, but since I have found no other material I hesitate to definitely accept this boreal variety. It was defined as follows: "thallus *erectus, brevis,* subcaespitosus, *rigidus,* fusco-niger, nitidus, *sorediis destitutus,* apicibus curvato-deflexis *concoloribus.*" "Norlandiae . . . Finmarkiae . . . Dovrensium."

Material from St. Pauls island and Baffin land I have referred to *jubata,* though in every respect they answer to this description, except for their *prostrate* and slightly soraliate condition,—they may however be better placed under *chalybeiformis.*

SPECIMENS EXAMINED

NEWFOUNDLAND: Sampson Is., *A. C. Waghorne,* Sept. 11, 1893 ?(CEC). ONTARIO: Nipigon river, *Macoun,* July 2, 1884 (CGS); Cache Lake, July 11, 1900 (CGS); Belleville, Aug. 17, 1868 (CGS). NOVA SCOTIA: Halifax, *J. W. Eckfeldt,* Aug. 4, 1890 (ANS). NEW BRUNSWICK: (S); Cape Breton island, *Macoun,* July 9, 1898 (CGS). MAINE: South West Harbor, *S. Lorvey,* Aug. 19, 1909 (1706 H); North Lubec, *C. E. Cummings,* etc., July, 1893, No. 16. Lich. Bor. Amer. (390 H); Brunswick, *M. Copeland,* July, 1909 (1157 H); Gerrish Is., *C. P. Heffenger,* 1910 (1971 H); Megunticook Lake, *A. L. Crockett,* Jan. 28, 1903 (8 SM); Manchester, *F. L. Scribner,* 1876 (ANS); Lubec, *P. L. Riker,* July 23, 1897 (NH); Cumberland, *Blake,* Dec., 1855 (NH et 980 F); Manchester, *F. LeR. Sargent* (NH); Portland, *A. H. Norton* (P); Fryeberg, *L. W. Riddle,* Aug., 1907 (1 R); Portage, *L. W. Riddle,* Aug., 1907 (112 R); Old Town, *L. W. Riddle,* Aug., 1907 (113 R); Orono, *M. L. Fernald,* July 11, 1892 (CEC); Cumberland, *J. Blake,* Dec. 5, 1855 (UM); Belmont, *J. Blake,* Sept. 17, 1878 (UM); Orono, *F. H. Harvey,* Oct., 1893 (UM); Bangor, *E. D. Merrill,* May 23, 1896 (UM). NEW HAMPSHIRE: Fitzwilliam, *F. J. Bassett,* Aug., 1909 (1679 H); Mt. Monadnock, 2,000 ft., *R. H. Howe, Jr.,* Apr. 5, 1906 (391 H); Hanover, *F. G. Blake,* Oct. 31, 1905 (388 H); Nashua, *P. Mott,* Sept. 29, 1908 (40 H); Rye, *C. P. Heffenger,* Apr., 1910 (1899 H); Belknap Co., *L. A. Carter,* Aug. 6, 1901 (6

SM); Plymouth, *C. E. Cummings,* Mar., 1891 (CEC). VERMONT: Norwich, *F. G. Blake,* Dec. 6, 1905 (386 H). MASSACHUSETTS: Sudbury, *C. M. Carr,* Oct. 17, 1905 (387 H); Townsend, *R. H. Howe, Jr.,* Dec. 28, 1905 (385 H); Worcester, *E. L. Horr,* Jan., 1906 (381 H); Mt. Watatic, 1,500 ft., *R. H. Howe, Jr.,* Dec. 28, 1905 (383 H); Bedford, *R. H. Howe, Jr.,* Jan. 26, 1906 (382 H); Carlise, *R. H. Howe, Jr.,* Oct. 22, 1905 (384 H); Mt. Toby, *T. P. Adams* (S); Amherst, *A. Clark,* 1875 (NH); New Bedford, *H. Willey,* 1862–98 (NH); Wellesley, *C. E. Cummings,* Dec. 21, 1883 (W); New Bedford, *H. Willey* (B); Hingham, Russell (B). RHODE ISLAND: *T. J. Bennett* (R); *Olney?,* Mar. 29, 1846 (B); *Olney?,* Dec. 11, 1847 (B). CONNECTICUT: Cromwell, *H. A. Green,* July 10, 1887 (979 F); Ellsworth, *H. A. Green,* Aug. 9, 1884 (1278 CM). NEW YORK: Chilson Lake, *C. W. Harris,* Aug. 1, 1900 (3 SM, NH, et NY); Penn Yan, *P. V. LeRoy* (NY); *L. W. Riddle,* Jan., 1908 (406 R); *Sortwell* (B). NEW JERSEY: Closter (CGS). PENNSYLVANIA: Bucks Co., May 30, 1883 (ANS). MARYLAND: Hamilton, *C. C. Plitt,* Dec. 14, 1909 (CCP). DISTRICT OF COLUMBIA: *E. Lehnest,* 1883 (NH). VIRGINIA: Hot Springs, 1851 (S); Norton, Cumberland Mts., *A. B. Seymour,* July 27, 1891 (No. 53, Dec. No. Amer. Lich. (BSNH); White Top Mt., 5678 ft., *H. D. Leming,* July 26, 1892 (CEC). IOWA: Fayette, *B. Fink* (1896 H); Clayton Co., *B. Fink,* 1895 (3187 F). MINNESOTA: Beaver Bay, *B. Fink,* July 15, 1807 (NH); Snow Bank Lake, *B. Fink,* July 20, 1897 (3185 F); *B. Fink,* 1896 (3184 F). OREGON: *W. W. Calkins* (W). ASSINIBOIA: Farewell creek, *Macoun,* June 27, 1895 (CGS). ALBERTA: Jumping Pound creek, *J. Macoun,* June 14, 1897 (CGS). BRITISH COLUMBIA: Mt. Benson, Vancouver island, *Macoun,* June 27, 1893 (CGS). ALASKA: Unalaska, *J. Macoun,* Aug. 21, 1891 (ANS, CGS).

ALECTORIA BICOLOR (Ehrh.) Nyl. Prod. Lich. Gall. et Alg., Act. Soc. Linn. **1**: 291. 1856, separate 45

Lichen bicolor Ehrh. l. c. 82.

TYPE: Plantas cryptogamas Linnaei, Decade **4**: No. 40. 1784.

TYPE LOCALITY: "Rennekeberg und Rehberg," Germany.

CRICINAL DESCRIPTION: "Er ist ein Lichen filamentosus, ramo-

sissimus, erectiusculus, teres, inarticulatus, glaber, nitidus, inanis, infra nigricans, supra sordide albidus, intus griseus; ramis patentissimis: extremitatibus simplicibus, subulatus," Ehrh., Beitrage zur Naturkunde, **3**: 82–83. 1788.

FIGURES: Acharius, Nya Handl. Kongl. Vetenskaps Acad., Stockholm, **22**: *pl. 4. f. 6a–b.* 1801.

Sowerby, Eng. Bot. **26**: *pl. 1853.* 1808.

DIAGNOSIS: *Thallus caespitose,* proximally *black,* apices *pale,* branches rigid, nitidous.

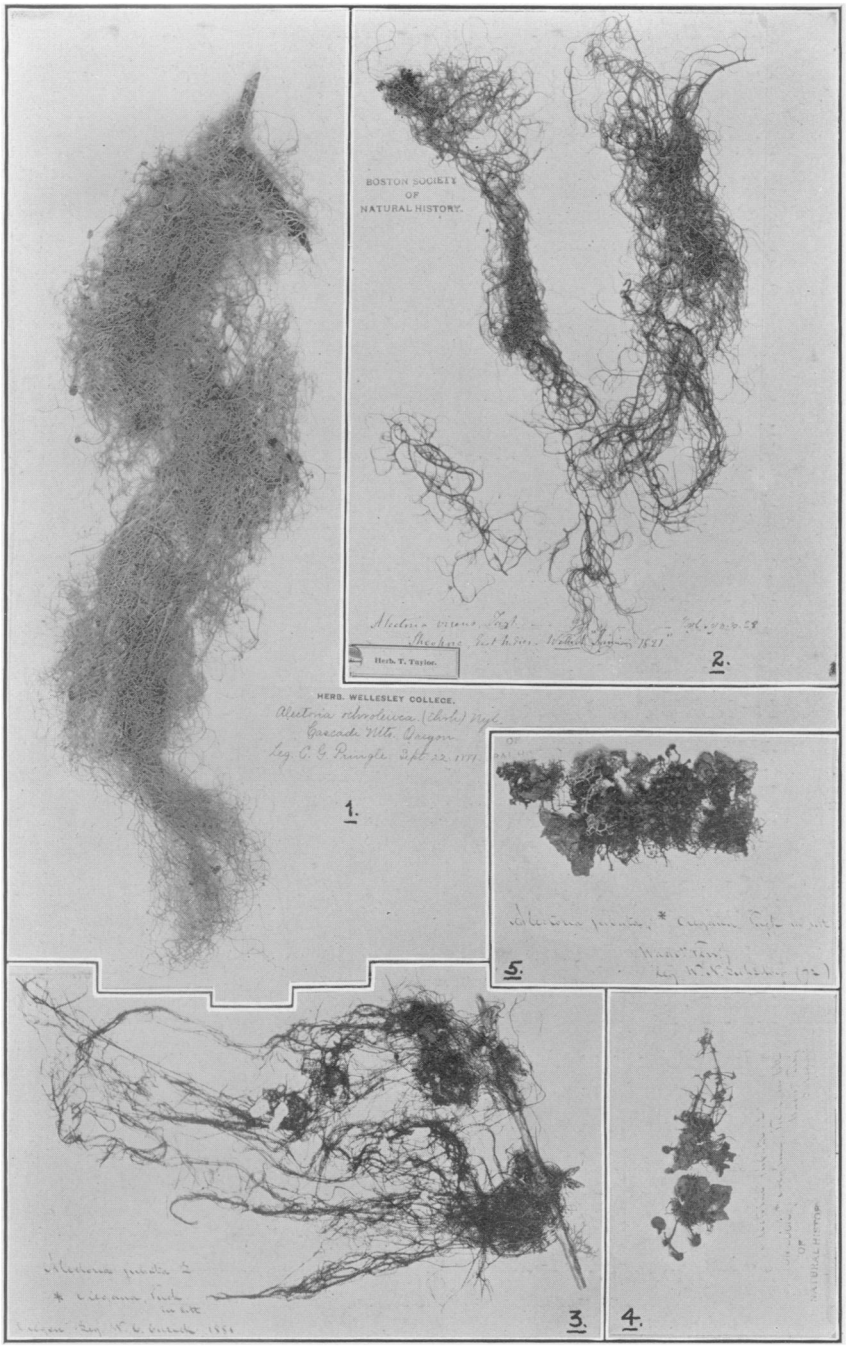
DESCRIPTION: *Thallus* caespitose, erect or procumbent, filamentous, rigid, branches terete, proximal portions black, apices paler to yellowish; *cortex* nitidous, occasionally slightly ruptured with soralia; *primary branches* dichotomous, divaricate, flexuous, slender (max. length 11 cm.); *secondary branches* dichotomous, divaricate; *fibrils* short. *Apothecia* lateral, rare, small (max. diam. 2–3 mm.), convex, innate-marginate, disk concolorous, or pale brown. *Spores* 5–9 × 4–7μ.

SUBSTRATA: On earth, and with mosses over rocks, also on coniferous trees.

GEOGRAPHICAL DISTRIBUTION: Common in the Boreal zone. It has been reported from the following eastern stations: Greenland (*Vahl*); Labrador (*Arnold and others*); Newfoundland (*Eckfeldt, Arnold*); Maine (*Eckfeldt*); New Hampshire (*Tuckerman*). Dr. Eckfeldt records it from Sussex Co., N. J., but in view of the plant's boreal range this record seems doubtful. The only western station is Alaska (*Cummings*). I have seen the typical plant from Labrador, New Hampshire, and Maine, on the Atlantic coast, and from British Columbia, Alberta, Yukon, and Alaska on the Pacific.

OBSERVATIONS: This plant is likely to be confused only with *nitidula,* and particularly, as already noted, with *chalybeiformis.* From the former it may be distinguished by its bicolored and more slender thallus, and simple apices; from the latter by its espinulose and esoraliate branches, which are generally largely unicolored.

NOTE: *Alectoria bicolor Berengeriana* Mass. (Anzi, Lich. rariores veneti, etc., Fasc. I, No. 17. 1863) has been reported from Newfoundland by Stizenberger—"Berenger und in Newfoundland (im Herbar Hegelschw. als *A. divergens*)," l. c. 127.



SPECIES OF ALECTORIA

I have seen but one European specimen of this plant (NY) which seems like a highly spinulose condition of *chalybeiformis*. I have been unable to secure the original description of this variety.

SPECIMENS EXAMINED

LABRADOR: Battle Harbor, *A. C. Waghorne,* Aug. 25, 1891 (ANS). NEWFOUNDLAND: ? Harbor, *A. C. Waghorne,* 1890 (ANS). MAINE: Blanchard, *F. G. Blake,* Jan. 1909 (1818 H); Camden, *A. L. Crockett,* May 18, 1901 (4 SM). NEW HAMPSHIRE: White mts., *Tuckerman,* fertile (S); *Tuckerman,* 1840 (NH); Mt. Liberty, *C. E. Cummings,* Aug. 24, 1892 (3183 F); Franconia mts., *C. E. Cummings,* Aug. 19, 1893? (ANS). ALBERTA: Morley, *Macoun,* June 13, 1885 (CGS). BRITISH COLUMBIA: New Westminster, *J. Macoun,* Aug. 28, 1893 (ANS). YUKON: Crater Lake, *R. S. Williams,* May 24, 1898 (1861 H). ALASKA: St. Pauls Is., July 24, 1897 (3181 F); Kakutat Bay, *W. Trelease,* June 22, 1899 (CEC); Baranoff Is., *DeA. Saunders,* June 15, 1899 (CEC).

ALECTORIA OREGANA Nyl. ex Tuck. Herb. Lich. Japoniae, Accedunt obser. Lich. in Labuan, Paris, 104. 1890

TYPE: No. 72, Tuckerman herbarium, Botanic Museum, Harvard University, Cambridge, Mass., fide *Dr. Farlow.*

TYPE LOCALITY: Oregon.

ORIGINAL DESCRIPTION: "Subsimilis *A. prolixae* f. *lanestris* Ach., thallo fusco-nigricante tenui denso; apothecia spadicea (latit. 2–5 millim.), receptaculo ciliato; sporae 8 nae breviter ellipsoidaea, long. 0.005–6, crass. 0.0035–43 millim. I gel. hym. coerulescens, dein fulvescens. Thallus basi pallescens K (CaCl) —. — In Oregon (corticola videtur), species insignis praesertim apotheciis receptaculo usneoideo-ciliato."

DIAGNOSIS: *Thallus* caespitose to pendulose, *red-brown,* apothecial margins *fimbrio-ciliate.*

DESCRIPTION: *Thallus* caespitose to pendulous, rigid-filamentous portions lax, subterete to compressed, brown to reddish-brown; *cortex* glabrous, dull, rarely nitidous, subcanaliculate; *primary branches* rigid, short (2 cm.), stout, subdichotomous, becoming filiform and pendulous; *secondary branches* filiform; pendulous, subdichotomous; *fibrils* capillaceous. *Apothecia* common, small (max. dia. 7 mm.), appendiculate or lateral,

convex, emarginate, periphery fimbrio-ciliate, concolorous to dark brown. *Spores* 5–8 × 3–5μ.

SUBSTRATA: On trees.

GEOGRAPHICAL DISTRIBUTION: Confined apparently to the Boreal zone of the western coast states from California to British Columbia, east to western Montana. The San Diego record seems very doubtful from the point of view of locality.

OBSERVATIONS: This alpine species, described by Nylander after Tuckerman's death, though restricted in its range, is one of the most unique and easily determined species. It is commonly fertile, and its ciliate apothecia distinguish it at once from all other species of our area.

SPECIMENS EXAMINED

CALIFORNIA: Mt. Shasta, 3,800 ft., *G. M. Pendleton,* Sept. 12, 1909 (1094 SM); Sisson, *M. A. Howe,* July, 1894 (NY); San Diego, *E. Palmer,* 1875? (NH); Tehachapi mts., 3,000 ft., *H. E. Hasse,* 1901 (1844 H). OREGON: Union, *W. C. Cusick,* 1879 et 1881 (S et NH); *Suksdorf* (NH); Union, *W. C. Cusick* (CEC). WASHINGTON: Goldendale, *A. S. Foster,* Dec. 10, 1909 (941 SM); Spokane, *T. A. Bonser,* Apr., 1908 (730 SM); *W. N. Suksdorf,* No. 72. Cotype (S); *W. W. Calkins* (W). MONTANA: Columbia Falls, *R. S. Williams,* Apr. 27, 1893 (NY); Columbia Falls, *R. S. Williams,* Oct. 31, 1894 (ANS); Belt mts., *R. S. Williams,* Sept. 15, 1890 (NH); Columbia Falls, no. 96 Decades No. Amer. Lich., *Cummings, R. S. Williams,* Apr. 27, 1893 (402 H); Columbia falls, No. 18 Lich. Bor. Amer., *R. S. Williams,* Apr. 27, 1893 (3173 F). BRITISH COLUMBIA: Kootanay Lake, 6,000 ft., *Macoun* (CGS).

NOTE: Stizenberger* described in the Proceedings of the California Academy (5: (2), 537–538. 1895) a new caespitose *Alectoria* from Guadalupe Island off the coast of Lower California. The type or topotype is now in the National herbarium with a postal card from Stizenberger to Henry Willey from whom he received the plant dated August 24, 1893. In view of the fact that only scanty, sterile material is available I prefer to give here only Stizenberger's account:

* A List of Lichens collected by Mr. Robert Reuleaux in the Western Parts of N. America.

"It still remains to add here the diagnosis of a new western lichen, kindly sent me by Mr. Henry Willey, New Bedford, Mass.

"*Alectoria pacifica* Stzb. n. sp.

"Thallus fruticulose, prostrate, rigid, terete, smooth, brown and shining, from 1 to 1.5 cm. in length, 1–0.5 mm. in width, very much divaricately branched, the branches flexuous, densely intangled, 0.05 mm. in width, apothecia and spermogonia unknown.

"The anatomical structure perfectly agreeing with *Alectoria;* no traces of an orthogonal-trajectoric direction of hyphae (as it is found in *Cetraria aculeata*). Cortical and medullary layer equal, nearly longitudinally running filamentous elements. No central cavity; medullary layer cottony, very loose, sprinkled with heaps of gonidia (these 0.004–8 mm. in diameter). Thin sections of the thallus bordered with a very thin light-brown line. The cortical layer neither thickened nor interrupted by layer cavities (which are frequent in the older cortical tissue of *Cetraria*). No reactions on application of hydrate of potassa and hypochlorite of lime.

"Found in the Island of Guadalupe (Pacific Ocean), on humous earth, by Dr. [E.] Palmer [in 1875]."

NOTE: *Alectoria divergens abbreviata* Müll. Arg. Lich. Oregonenses, Flora, **72**: 362. 1889. This form was described as follows: "Mt. Hood in Oregon, ad terram et ramulos dejectos: n. III, forma abbreviata, vix pollicaris, compacta, fertilis, sporis 8^n, 6–9μ longis et 4½–5½μ latis."

ALECTORIA JUBATA (L.) Ach. Lich. Univ. 592. 1810
Lichen jubatus L. l. c.

TYPE: Species based on *Usnea jubata nigricans,* etc., of Dillenius; the Dillenian specimens "sterile . . . quite typical" are in the Dillenian herbarium, Botanic Gardens, Oxford, England, and are *Alectoria jubata* (*prolixa*), Ach. fide *Crombie.* In the Linnaean herbarium the species is represented by composite material, though "No. 73 = in 1 folio: *Alectoria chalybeiformis prolixa* (Ach.) . . . in alio folio . . . *Alectoria jubatae* Wainio," fide *Wainio.*

TYPE LOCALITY: "Europae."

ORIGINAL DESCRIPTION: "filamentosus pendulus: axillis compressis," L. Sp. Pl. **2**: 1155. 1753.

FIGURES: [Dill. Hist. Musc. *pl. 12. f. 7.* 1841].

DIAGNOSIS: *Thallus* pendulous, brown, primary branches sulciform, subterete, axils compressed. *Apothecia concolorous* or pale brown.

DESCRIPTION: *Thallus* pendulous, filamentous, pliant, subterete, subtortulous, brown; *cortex* glabrous or dull, sulciform, rarely ruptured with white soralia; *primary branches* remotely dichotomous, axils compressed (max. length 40 to 50 cm.); *secondary* branches dichotomous slender, filiform; *fibrils* capillaceous. *Apothecia* rare, small (max. diam. 2 mm.), convex, innate, margin entire, disk dull, concolorous or pale yellowish. *Spores* 5–9 × 4–7μ.

CONTINGENT PHASES: (*a*) Cinereous or partially cinereous (*Alectoria jubata cana* Ach. l. c. 593).

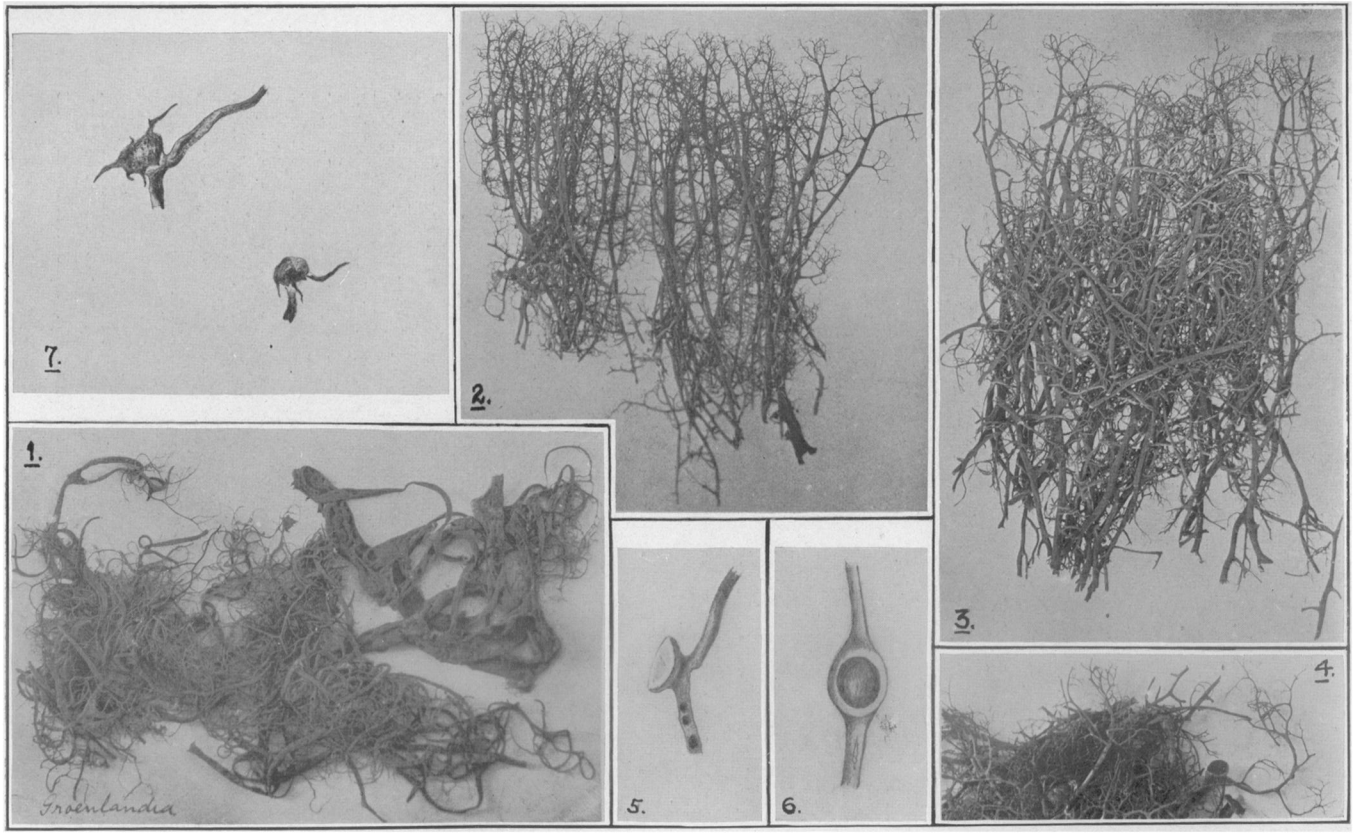
SUBSTRATA: On living and dead coniferous and deciduous trees, more common on the former.

GEOGRAPHICAL DISTRIBUTION: This plant is not typically represented in North America, but is largely replaced in the west by the closely allied species *Fremontii.*

OBSERVATIONS: As was in the case of the genus *Usnea, jubata* like *barbata* has come to have a sectional rather than a specific concept, and the varieties *prolixa* and *implexa* have included *jubata,* or else *jubata* has stood for merely atypical specimens of the varieties. Stizenberger* dropped *jubata* altogether, beginning his nomenclature from Acharius, but as *jubata* seems to be unquestionably a synonym of *prolixa,* and has priority, it must stand. *Prolixa* (sulciform) has never in this country (*Macoun*) been seriously considered as a valid variety, and it is generally known as a variety of *jubata. Implexa* has been given correctly by American lichenologists to the slender, eastern specimens whose length does not usually exceed 10 to 15 cm., while *jubata* has been often wrongly reserved by careful workers for the sterile examples of *Fremontii.*

Tuckerman's diagnosis of *jubata* includes the entire range from tufted conditions of the variety *chalybeiformis* to the pendulous *implexa,* and also those pale specimens referable to the variety *subcana.* Below, under (*b*) and (*c*), he gives additional

* See also Hue, Lich. extra-Europ. Nouv. Arch. Mus. d'hist. nat. 1: (4). 86. 1899.



SPECIES OF ALECTORIA

characters to distinguish the varieties. *Jubata* in the Tuckerman sense, like *barbata,* therefore, it will be seen includes collective specific characters.

Crombie has brought into use the chemical tests to separate *implexa* from *jubata,* but though I have faithfully tried them I fail to find the reactions conclusive or helpful. Crombie's results, moreover, do not agree with those given by Nylander. Stizenberger, however, claimed that Nylander's tests "brachte allmälig* Licht in das Chaos," and though not questioning their diagnostic aid, I have sought and found structural differences of value, though intergradation undoubtedly occurs.

The brown, pendulous species of *Alectoria* are plants of wide cosmopolitan distribution. From their high development, like *Usnea,* during an evidently extended evolution by three modes of reproduction (spore, soralial, fragmentary) they have become wonderfully variable, and as with all the filamentous, cylindrical species now rarely develop apothecia. The fragmentary method of reproduction is not only the most common, but hinders the apothecial, which consequently becomes rare. There seems to exist for each lichen species, however, an area where particularly acceptable environment finds a usually sterile species fruiting commonly, *i. e., Usnea angulata* Ach. in the Bolivian Andes. In both hemispheres a maximum length of 30 to 40 cm. is reached, and the plants show a color gradation from almost black-brown to pale gray. A parallelism with *Usnea* in the matter of distributional development is clearly shown; central Europe and the northern Pacific coast supporting the most luxuriant growths,—eastern United States the most reduced.

I have included in this paper a diagnosis and description of true *jubata* that students may recognize the limits of *jubata,* and be able to make comparisons with our allied species. A clear understanding of *jubata* will I think eliminate the future erroneous recording of it from this continent. Personally I have yet to see a typical specimen from North America, its nearest congeneric representative being *Fremontii,* while the variety *implexa* that follows, is the plant common to the larger part of our area.

* Stizenberger uses this word to indicate early discrepancies among authors.

Stizenberger did not report his synonymous *prolixa* from our area, attributing it only to Greenland.

I am listing after this species, plants that seem to me transitional examples, though they for the most part more nearly approach the variety *implexa*. The locations given indicate a somewhat local region of our area, where such specimens are evidently most likely to be found. This area it will be noted, more or less coincides with that of heavy rainfall.*

NOTE: *Alectoria jubata stricta* Ach. (Lich. Univ. 592. 1810). Distributed by Prof. John Macoun from Colquitz river, Victoria, British Columbia. The material is inseparable from the var. *implexa,* and Acharius' variety has not been to my knowledge recognized in recent years. The original description is as follows: No type locality was cited, "lorulis ramulisque pendulis coarctatis rigidiusculis strictis nigris."

SPECIMENS EXAMINED

TENNESSEE: ?, *W. W. Calkins,* July, 1889 (1268 CM). COLORADO: ?, *Vasey* (NH); Boulder Co., *A. Morgan,* Mar., 1898 (CEC). MINNESOTA: Grand Portage, *B. Fink,* May 18, 1897 (NH). IDAHO: Lake Waha, 2,000 ft., *A. A. & E. G. Heller,* July 3, 1896 (NH). UTAH: Uintah mts., 7,500 ft., *L. H. Pammel,* July, 1902 (6568 F). OREGON: Mt. Hood, *T. Howell,* Oct. 30, 1882 (ANS); Castle Crag Springs, *F. A. Walpole,* Aug. 27, 1902 (NH); ?, *W. N. Suksdorf* (NH); ?, *E. Hall,* 1876 (NH); Mt. Hood, 3,000 ft., *F. C. Frye,* Aug. 28, 1907 (4,870 ft., F); Mt. Hood, 3,000 ft., *A. S. Foster* (R). BRITISH COLUMBIA: ?, *J. T. Rothcock,* 1865 (NH); Emerald Lake, 4,300 ft., *A. Patterson,* June 29, 1904 (CM); Big Bend, 6,000 ft., *H. Shaw,* July 24, 1905 (3563 CM); Mt. Benson, Vancouver, *Macoun,* July 10, 1893 (CGS); Spencer's Bridge, *Macoun,* May 28, 1889 (CGS); Revelstone, *Macoun,* May 16, 1890 (CGS), Skeena river, *J. M. Macoun,* Oct. 2, 1891 (CGS). NEW BRUNSWICK: Prince Edward Island, *Macoun,* July 16, 1888 (CGS). NEWFOUNDLAND: New Harbor, *A. C. Waghorne* (ANS); (S). FRANK-

* Arnold: records the synonymous var. *prolixa* from Labrador and Newfoundland. Lich. Fragm. l. c. 1896, 1899. Müller Arg. from Washington (Flora: 72: 262. 1889).

LIN: Baffin Land, *R. Bell,* July, 1897 (CGS). ALASKA: St. Paul Island, *J. M. Macoun,* Aug. 18, 1892 (CGS).

ALECTORIA JUBATA IMPLEXA (Hoffm.) Ach. Lich. Univ. 593. 1810

Usnea implexa Hoffm. l. c. 134. 1795.

Setaria trichodes Mich. Flora Bor. Amer. **2**: 331. 1803.

Alectoria jubata f. *minuscula* Merrill, Bryologist, **14**: 36. 1911.

TYPE: "*Usnea implexa* (Hb. viv. p. 453: *U. implexa* Hoffm. Germ.") = *Alectoriae jubatae* (Wainio, Adj. 8, p. 116) lusus, thallo tenuiore, quam in *setacea* Ach., cui habitu satis est similis, basin versus cano, apice obscurato." Fide *Wainio* in Meddel. Soc. Fauna et Flora fennica, **14**: 12. 1886.

TYPE LOCALITY: "Deutschland."

ORIGINAL DESCRIPTION: "*U. implexa,* filamentosa decumbens implexa, filis longis divaricatis simpliciusculis.)," Deut. Flora, **2**: 134–135. 1795.

FIGURE: Schrad., Jour. Bot. **1**: *pl. 3. f. 4.* 1799.

Sowerby, Eng. Bot. **27**: *pl. 1880.* 1808.

Fink, Lich. Minn. Contrib. U. S. Nat. Herb. **14**: *pl. 42.* 1910.

DIAGNOSIS: *Thallus* pendulous, brown, branches terete, *filiform throughout.* Apothecia brown.

DESCRIPTION: *Thallus* pendulous, filamentous, lax, terete, occasionally tortulous, brown to black, rarely paler; *cortex* glabrous or nitidous, often ruptured with white soralia; *primary branches* dichotomous, slender (max. length 38 cm.); *secondary branches* dichotomous, slender; *fibrils* capillaceous. *Apothecia* lateral, rare, very small (max. diam. 2 mm.), convex, innate-marginate, disk concolorous or pale brownish yellow. *Spores* as in *jubata.*

CONTINGENT PHASES: (*a*) Thallus entirely or partially gray (*Alectoria jubata subcana* Nyl. Jour. Bot. **14**: 360. 1876), (*b*) becoming virescent approaching *A. virens* Tayl., *A. tortuosa* Merr.?

SUBSTRATA: As in *jubata.*

GEOGRAPHICAL DISTRIBUTION: Common throughout the Transition and Boreal zones. It extends in the east from North Carolina (*Curtis*) to Labrador (*Cummings* and *Eckfeldt*); in the west from San Quintin, Lower California, to Yukon and Alaska

(*Cummings*), in which area it is rare. In the middle west it is found commonly from Wyoming, South Dakota, and Minnesota (*Fink*) northward. It is also found in the boreal swamps of the upper Austral zone.

OBSERVATIONS: Though this plant has been accepted recently as a full species intergrades are so common that it seems inadvisable to consider *implexa* other than a variety, particularly as it appears to be nothing more than a less rank, slender condition of *jubata,* which inhabits the regions of moderate rainfall and moisture. The branches in the typical examples of the variety are terete and uniformly slender, even from the proximal portions nearly to the apices. There is little suggestion of the coarse, remotely branched proximal portions changing almost abruptly into the capillaceous, tufted extremities so characteristic of true *jubata* and *fremontii,* and even *oregana.* No great difficulty presents itself in the separation of the variety from the species, especially for North American workers, as the rank, robust, typical *jubata* is replaced in our area by the following species for which in the majority of cases we have marked diagnostic characters. The eastern examples which are those most often fruited and esoraliate have been designated by Mr. Merrill (Bryologist **14**: 36. 1911) as forma *minuscula,* but this is a name given to a condition of growth, and not in my opinion worth especial nomenclatural recognition. Moreover the plant originally described was esoraliate.

SPECIMENS EXAMINED

LABRADOR: Indian harbor, *A. C. Waghorne,* Sept. 7, 1891 (ANS); Blanc Sablon, *A. C. Waghorne,* July 21, 1893 (NH, CGS); ANTICOSTI: Gunn river, *Macoun,* July 29, 1883 (CGS). NEWFOUNDLAND: New harbor, *A. C. Waghorne,* 1890 (ANS); Exploits bay, *A. C. Waghorne,* (CEC); White bay, *A. C. Waghorne,* May 11, 1891 (CEC); (S); Notre Dame bay, *A. C. Waghorne,* 1893 (CGS). NOVA SCOTIA: Halifax, *J. W. Eckfeldt,* Aug. 4, 1890 (ANS); Truro, *Macoun,* June 12, 1883 (CGS); Cape Breton island, *Macoun,* July 9, 1898 (CGS). NEW BRUNSWICK: Cain river, *A. Fernald,* Oct., 1899 (1794 H); Grand

Menan, 1879 (NH, S). MAINE: No. East harbor, *R. W. Kelso,* 1906 (398 et 393 H); No. Haven, *Hopkins,* Jan. 1, 1906 (396 H); Southwest harbor, *S. Lurvey,* Aug. 19, 1909 (1705 H); Blanchard, *F. G. Blake,* Jan., 1909 (1120 H); Brunswick, *M. Copeland,* Jan., 1909 (1149 H); Rangeley, *C. P. Heffenger,* 1910 (1968 H); Bangor, *E. D. Merrill,* Apr. 23, 1896 (NH, UM); Portland, *A. H. Norton* (P); Portage, *R. W. Riddle,* Aug., 1907 (R); Orono, *E. D. Merrill,* May 23, 1896 (CEC). NEW HAMPSHIRE: Fitzwilliam, 1,000 ft., *R. H. Howe, Jr.,* July 31, 1910 (1922 H); Sandwich Dome, 3,500 ft., *W. S. Hinchman,* July 18, 1909 (1656 H); Mt. Madison, 4,000 ft., *T. T. McCabe,* Dec. 27, 1908 (1055 H); Mt. Clinton, 4,000 ft., *R. H. Howe, Jr.,* Sept. 22, 1908 (64 H); Randolph, *C. E. Cummings,* Aug. 3, 1889 (CEC); Plymouth, *C. E. Cummings,* May, 1891 (CEC). VERMONT: Mt. Ascutney, 3,000 ft., *R. H. Howe, Jr.,* Aug. 25, 1909 (1665 H). MASSACHUSETTS: Sudbury, *C. M. Carr,* Oct. 17, 1905 (395, 397 H); New Bedford, *H. Willey,* 1862–98 (NH); Amherst, *A. Clark,* 1875 (NH); Wellesley, *C. E. Cummings,* Dec., 1883 (W). NEW YORK: Catskill mts., *G. B. Kaiser,* Aug. 5, 1910 (SM); Adirondack mts., *C. H. Peck* (NY). NEW JERSEY: Budd's lake, *P. V. LeRoy,* Oct., 1871 (NY). PENNSYLVANIA: Delaware Co. (ANS). QUEBEC: Murray Bay, *D. P. Morgan,* Sept. 1, 1909 (1676 H); Fraser falls, Murray Bay river, Aug. 11, 1905; phase *a* (CGS); Shickshock mts., Aug. 26, 1883 (CGS); Montmorency river, June 30, 1905 (CGS). ONTARIO: Ottawa, *J. Macoun,* Oct. 19, 1899 (NH, CEC, 983 F); Nipigon river, *Macoun,* July 2, 1884 (CGS). KEEWATIN: *J. W. Tyrrell,* July 25, 1893 (CGS); Algonquin park, June 13, 1900 (CGS). LAKE SUPERIOR: *Mrs. Roy* (NY); *J. Macoun,* July 27, 1869 (NH); *E. Deser* (TH). MINNESOTA: Grand Portage island, *B. Fink,* June 18, 1897 (1869 H, 3182 F); Lake Superior, *E. Deser,* 1849 (S); Midway creek, *F. F. Wood,* Aug. 10, 1899 (ANS); Misquah hills, *B. Fink,* July 5, 1897 (NH, 3179 F); Current river, 1869 (CGS). MANITOBA: Porcupine mts., *Macoun,* July 21, 1881 (CGS). MONTANA: Roger's Ranch, *M. E. Jones,* Aug. 22, 1910 (1984 H). WYOMING: Shoshone lake, *J. M. Coulter,* 1872 (NH). COLORADO: Tusin lakes, *J. Wolf,* 1873 (ANS). IDAHO: Priest's lake, 660 m., *D. T. MacDougal,* Aug.

1, 1900 (NY); Lake Waha, 2,000 ft., *A. A. & E. G. Heller,* July 2, 1896 (B). LOWER CALIFORNIA: San Quintin (1983 H). CALIFORNIA: Santa Cruz pen., Black mts., 1,800 ft., *A. C. Herre,* Apr. 30, 1904, (1981 H); Santa Cruz mts., Castle Rock ridge, 2,500 ft., *A. C. Herre,* June 16, 1908 (1979 H). WASHINGTON: (?), *Brandegee* (S); Mt. Ranier, 6,000 ft., *T. C. Frye,* Aug. 11, 1904 (4855 F); Olympic mts., 5,000 ft., *T. C. Frye,* Aug. 14, 1907 (4818 F); (?), *W. W. Calkins* (W); Puget sd., Mt. Constitution, *B. Fink,* July 13, 1906 (5553 F); Friday harbor, *B. Fink,* June 28, 1906 (5613 F); Waldron island, *B. Fink,* July 10, 1906 (5552 F); San Juan island, *B. Fink,* July 27, 1906 (5429 F);* Mt. Ranier, 8,000 ft., *C. A. Mosier,* 1892 (NH). BRITISH COLUMBIA: Glacier, Hermit mt., 6,000 ft., *B. Fink,* Aug., 1906 (5865 F); Vancouver island, *W. Trelease,* June 2, 1899 (CEC); Skeena, *J. Macoun,* Oct. 2, 1891 (ANS); (?), *J. T. Rothcock,* 1865; Vancouver island, *J. Macoun,* May 10, 1893 (NH); Hectors, *J. Macoun,* Mar. 5, 1894 (4908 F); Vancouver island, Mt. Benson, *J. Macoun,* Oct. 7, 1893 (NY); Glacier, Lake Louise, 5,000 ft., *B. Fink,* Apr. 6, 1906 (5893 F); Victoria, *J. Macoun,* June 6, 1908 (W); Victoria, phase *a, Macoun,* May 6, 1893 (CGS); Vancouver island, May 7, 1875 (CGS); Hector, Aug. 5, 1904 (CGS); Vancouver island, Comox, *Macoun,* Apr. 30, 1887 (CGS); Donald, *Macoun,* July 3, 1885 (CGS); Mt. Benson, Vancouver island, *Macoun,* July 10, 1893 (CGS); Hastings, *Macoun,* Apr. 6, 1889 (CGS); Mt. Todd, 6,300 ft., *Dawson,* Sept. 17, 1888 (CGS). ALBERTA: Banff, *C. Crosby,* July 22, 1901 (5925 F); Banff, *Macoun,* July 24, 1891 (CGS); Jumping Pound Creek, *J. Macoun,* June 20, 1897 (CGS); Laggan, June 26, 1904 (CGS); Crow's Nest Pass, *J. Macoun,* Aug. 20, 1897 (CGS). BRITISH NORTH AMERICA: *Drummond* (TH); Lake Winnipegoosis, *J. Macoun,* 1882 (ANS). YUKON: Dawson, *R. S. Williams,* Oct. 2, 1898 (1858 H).

ALECTORIA FREMONTII Tuck. Proc. Amer. Acad. Arts & Sci. l. c.

TYPE: *Evernia Fremontii,* Tuck. MSS. Lich. Amer. sept. exsiccati, 3: no. 52. 1854.

* Contingent phase (*b*).

TYPE LOCALITY: "in montibus Californiae." "'Camp of Dec. 5, 6, 1854' (Sierra Nevada), 'California, abundant on Pines,' Col. Fremont (com. Torrey!). Hangs from the lower branches of all the coniferous trees of Northern California, and Southern Oregon."

ORIGINAL DESCRIPTION: "thallo filamentoso pendulo ramosissimo implexo tereti-compresso laevigato fusco-nigrescente, ramis inferioribus hic illic incrassatis lacunoso-excavatis flexuosis tortuosisque, superioribus apice tenuissimis, ultimis simplicibus; apotheciis innato-sessilibus ex urceolata denum planis margine tenuissimo evanido discum viridi-flavo-pruinosum cingenti," Proc. Amer, Acad. Arts & Sci. **25**: 422. 1858.

DIAGNOSIS: *Thallus* pendulous, reddish brown to black, branches compressed, sulciform and *foveolate, tortulous. Apothecia* and *soralia sulphureous.*

DESCRIPTION: *Thallus* pendulous, filamentous, pliant, subterete, or compressed, tortulous, reddish-brown to black, rarely pale; *cortex* glabrous or dull, sulciform and foveolate, occasionally with greenish or sulphurous soralia; *primary branches* compressed, remotely dichotomous (max. length 45 cm.); *secondary branches* dichotomous, slender, subterete; *fibrils* terete, capillaceous. *Apothecia* not uncommon, small (max. diam. 4 mm.), convex, innate, margin disappearing, disk pruinose, sulphureous. *Spores* 4–8 × 4–5μ.

CONTINGENT PHASES: (*a*) Partially cinereous or pale-brown.

SUBSTRATA: Coniferous trees, occasionally on deciduous growths.

GEOGRAPHICAL DISTRIBUTION: Confined to the Transition and Boreal zones on the Pacific coast, extending from southern California (2,000 ft.) to southern Alaska (*Cummings*), east to Idaho, Wyoming, Montana and Alberta. In the Academy of Natural Sciences at Philadelphia is a specimen labelled from Maine, sent Dr. J. W. Eckfeldt by Mr. G. K. Merrill. It seems quite evident that in some way this specimen has become mislabelled.

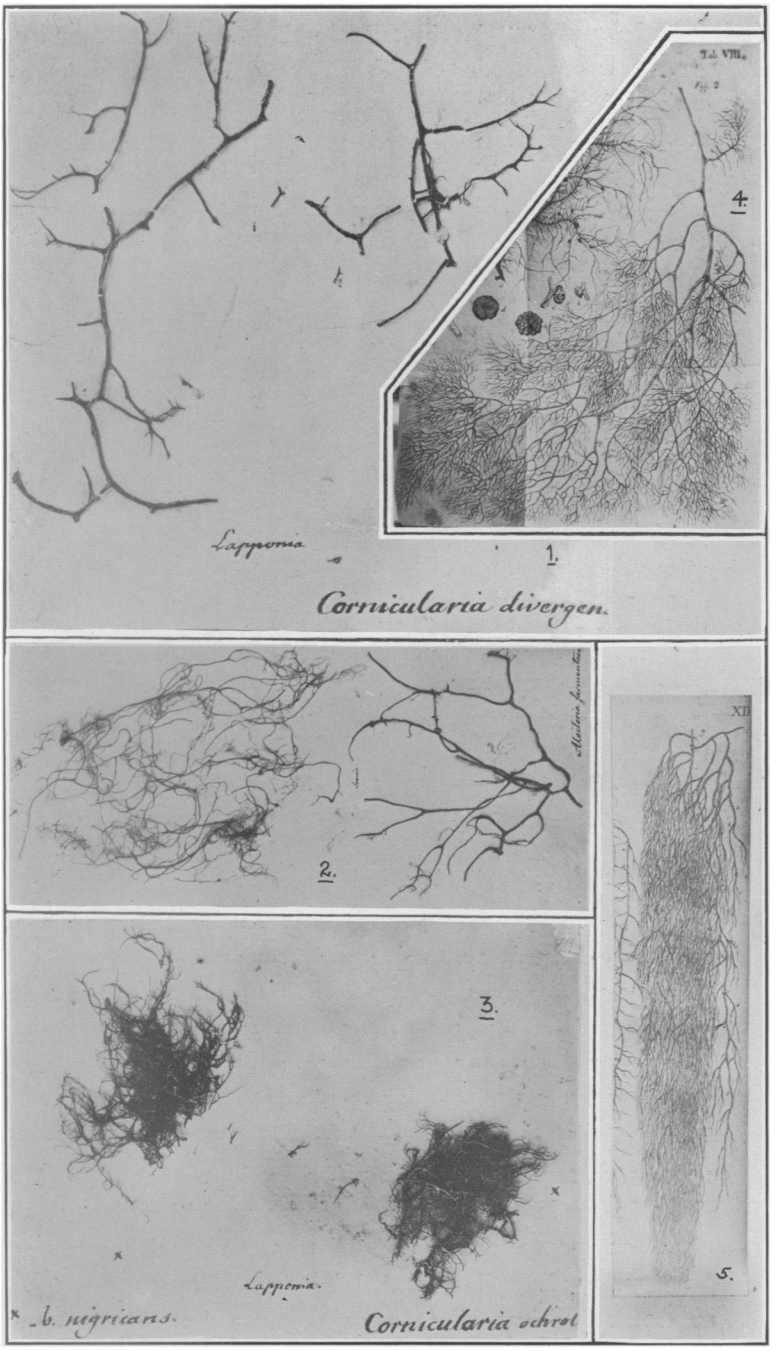
OBSERVATIONS: This species, no doubt a close *relative* of *jubata,* is, as has already been said, the most luxuriant *Bryopogon* of the *Alectorias* within our area. Its foveolate thallus and capillaceous extremities suggest strikingly *Usnea cavernosa* Tuck. Many of the plants attributed to *jubata* in reality belong here, and are placed elsewhere because they are sterile, and lack therefore

the diagnostic sulphureous disked apothecia. The soralia, however, though not common are just as characteristic, for so far as I have observed they are always yellow. In both true *jubata* and *implexa* they are white. It is evidently only the younger, efoveolate, esoraliate examples that are difficult to separate from *jubata,* and here the more tortulate condition of *Fremontii* is an aid.*

SPECIMENS EXAMINED

CALIFORNIA: San Jacinto mts., *H. E. Hasse,* 1893 (HEH, 1982 H, 4996 F); Tehachapi mts., 3,000 ft., *H. E. Hasse,* 1907 (1845 H); (?), *Mrs. Austin* (S); Sierra valley, *J. G. Lemmon* (S); Mt. Shasta, *M. A. Howe,* Aug. 5, 1904 (NY); (?), *E. J. Spence* (ANS); Mission Dolores, *E. Lehnest,* 1889 (ANS); Yosemite, *E. J. Spence,* Nov., 1882 (ANS); Sequoia Nat. Park, *W. Fry,* 1905 (NH); Round valley, 440 m., *V. K. Chestnut,* July 20, 1897 (NH); (?), *H. N. Bolander,* 1864 (NH); Sisson, *M. A. Howe,* July 24, 1894 (NH); Pedlar, 6,500 ft., *G. Hansen,* Oct. 3, 1894 (NH); *Fremont,* No. 52, *Tuck.* Amer. Sept. Exs. (TH). OREGON: Three Sister mts., *L. H. Mills,* Aug., 1910 (1929 H); Mt. Hood, *L. H. Larwood,* Feb. 18, 1907 (399 H); Central pt., *A. Ashworth,* Dec. 25, 1901 (7 SMC); Sanvier's island, *J. Howell* (S); Dallas, *T. Howell,* Oct. 30, 1882 (ANS); (?), *E. Hall,* Nov., 1880 (ANS); Mt. Hood, *T. Howell,* Oct. 30, 1882 (ANS); Minam river, 2,900 ft., *E. P. Sheldon* (NH); (?), Cusick (NH); (?), *E. Hall,* 1871 (NH); Mt. Hood, *J. W. Eckfeldt,* 1880 (CGS). WASHINGTON: Spokane, *J. F. Brownlee,* Sept. 15, 1902 (389 H); Spokane, *B. Labaree,* Dec. 27, 1908 (999 H); Goldendale, *A. S. Foster,* Dec. 20, 1909 (940 SMC); (?), *W. N. Suksdorf* (S, NH); Medical lake, 2,900 ft., *T. K. Richards,* Jan., 1911 (2000 H); Goldendale, *A. S. Foster,* Oct. 20, 1909 (R); (?), *W. W. Calkins* (3009 CM). IDAHO: Hayden lake, 2,200 ft., *T. K. Richards,* Aug. 10, 1909 (1614 H); (?), *A. I. Mulford,* July, 1892 (NY); Lake Waha, 2,000 ft., *A. A. & E. G. Heller,* July 3, 1896 (NY); Lake Pend d'Orielle, *J. B. Lieberg,* 1890 (ANS); Latah Co., *C. V. Piper,* June 16, 1893 (CEC). MONTANA: Columbia Falls, *R. S. Williams,* Apr., 1893 (Lich. Bor. Amer. No.

* "med gule soredier," Lynge, De Norske busk- og blad laver, Bergens Mus. Aarbog 9: 62. 1910 and Stizenberger l. c. 130 = "Soredien gelblich."



SPECIES OF ALECTORIA

17, Dec. No. Amer. Lich. No. 54); Columbia Falls, *R. S. Williams,* May 8, 1897 (1869 H); Missoula, *M. J. Elrod,* 1899 (1870 H); Stanton mt., 1,800 m., *F. K. Kreeland,* Aug. 30, 1908 (NY); Columbia Falls, *R. S. Williams,* May 31, 1895 (NH); Missoula, *M. J. Elrod,* 1899 (3176 F); Hayden creek, *M. J. Elrod* (4947 F); Warm springs, *L. H. Pammel,* 1904 (4667 F). BRITISH COLUMBIA: Deer Park, *J. Macoun,* June 3, 1890 (NH); Selkirk mts., 4,300 ft., *H. Petersen,* June 29, 1904 (NH); Glacier, Fairview mt., 4,000 ft., *B. Fink* (5900 F, 612 SMC); Sotewert's lake, June 20, 1875 (CGS); Lower Arrow Lake, *Macoun,* June 3, 1890 (CGS); Lecamous, *Macoun,* July 7, 1889 (CGS). ALBERTA: Canadian Rocky mts., *G. Martin,* Aug., 1909 (1806 H). BRITISH NORTH AMERICA: *Drummond* (TH). ?MAINE: Square lake, *G. K. Merrill,* Feb., 1884 (ANS).

SECT. II.: EUALECTORIA Th. Fr. Lich. Scand. 19. 1871.

Asci containing 4 (rarely 2) brown spores. Thallus light. Medulla arachnoid or absent.

ALECTORIA NIGRICANS (Ach.) Nyl. Lich. Scand. 71. 1861

Cornicularia ochroleuca nigricans Ach. l. c.

TYPE: Not indicated, but the specimen on which the species was based is in the Acharian herbarium at Helsingfors, fide *Elfving.*

TYPE LOCALITY: "in alpibus borealis Sueciae."

ORIGINAL DESCRIPTION: "thallo scabriusculo sordide fuscescente vel nigricante ad basin palidiori ramis ramulisque implexis nigris." Ach. Lich Univ. 615. 1810.

FIGURE: Nyl. Synop. *pl. 8. f. 17.* 1858–60.

DIAGNOSIS: *Thallus smaller* and more *slender* than in *ochroleuca,* branches attenuate, *chestnut,* apices *purplish*-black.

DESCRIPTION: *Thallus* erect, Cladoniform, rigid, rarely foveolate, branches slender, subterete, proximal portions chestnut, apices livid to blackening; *cortex* glabrous to dull, rarely papillate or striate; *primary branches* dichotomous, fruticulose, (max. length 10 cm.); *secondary branches* dichotomous; *fibrils* entangled, frutescent, furcate, attenuate. *Apothecia* as in following species (max. diam. 3 mm.). *Spores* (often 2 nae.) 21–35 × 15–20μ.

SUBSTRATA: On rocks, humus, mosses, rarely (?) on trees.

GEOGRAPHICAL DISTRIBUTION: Confined to the Boreal zone. It

has been recorded on the Atlantic coast from Maine (*Eckfeldt*) to Greenland (*Macoun, Stizenberger*), and at the following intermediate stations: Quebec (*Macoun*), Miquelon island (*Stizenberger*), Newfoundland (*Eckfeldt, Stizenberger, Arnold*), Hudson bay (*Macoun*), Labrador (*Arnold, Cummings, Eckfeldt, Macoun, Townsend & Allen*) and Baffin's bay (*Stizenberger*). On the Pacific coast it is reported from British Columbia (*Macoun*) to Alaska (*Hue, Rothcock, Cummings, Stizenberger*). In addition to these localities I have seen specimens from Melville island, Ungava and Keewatin.

OBSERVATIONS: Though this plant appears to be only a smaller, more slender color variety of *ochroleuca,* yet it has the unique property of conveying after a time a purplish tinge* to the herbarium envelopes, perhaps due to iodine† which is known to occur in some [marine] algae. When only a few filaments of its thallus have been gathered with *ochroleuca,* they indicate their presence by tinging just beneath them the paper on which they lie. This property offers the best diagnostic characteristic for the ready determination of long preserved‡ herbarium material. Its structural differences give sufficient grounds for its recognition as a full species. *Alectoria Thulensis* Th. Fr. (Lich. Arctoi, 28. 1860) which has been recorded from our area is the present species under a synonymous name.

SPECIMENS EXAMINED

NEWFOUNDLAND: *A. C. Waghorne,* 1892 (ANS); *M. A. Curtis* (NH); (S). LABRADOR: Blanc Sablon, *A. C. Waghorne,* 1894 (NY, NH); Seal harbor, *A. C. Waghorne,* Aug. 12, 1891 (ANS); Blanc Sablon, *A. C. Waghorne,* July 24, 1893 (CEC); Clearwater lake, *A. P. Low,* July 12, 1896 (CGS). UNGAVA: Mansfield island, *R. Bell,* Aug. 30, 1884 (CGS). GREENLAND: *Gischa* (TH); Christianshaab (NH). QUEBEC: Shickshock mts., *Gaspe,* Aug. 26, 1882 (CGS). FRANKLIN: Melville island, *E. Parry*

* Arnold: "Das Papier der beiden Umschlagebögen ist dort, wo die Flechte liegt, braun-röthlich gefärbt." Lich. Fragm. Oesterr. bot. Ztschr. 44: 2. 1894, and Crombie: Brit. Lich. 211. 1894.

† Found in sea water and mineral springs.

‡ Ten years or more.

(TH). KEEWATIN: Marble island (CGS). ALASKA: Pt. Barrow, *E. Leynest* (ANS); Unalaska island, *J. H. Bean,* Oct. 1, 1880 (NH); Cape Nome, *W. A. Setchell,* July 25, 1899 (CEC); St. Michaels, *L. M. Turner,* Oct. 11, 1875 (CEC); St. Michaels, *W. A. Setchell,* July 19, 1899 (CEC); St. Paul's island, *J. M. Macoun,* June 19, 1897 (CGS); St. George island, *J. M. Macoun,* June 7, 1897 (CGS). BRITISH COLUMBIA: Summit Gold Range, *Macoun,* Aug. 10, 1889 (CGS).

ALECTORIA OCHROLEUCA (Ehrh.) Nyl. Prod. Lich. Gall. et Alg. Act. Soc. Linn. Bord. **1**: 292. 1856, separate 46. 1857

Lichen ochroleucos Ehrh. l. c.

TYPE: Not indicated, but the specimen on which the species is based may possibly be found in Erhart's herbarium at Göttingen, or at Leipzig or Moscow, though I have been unable to definitely locate it.

TYPE LOCALITY: Not mentioned.

ORIGINAL DESCRIPTION: "dichotomo-ramosus, teres, erectiusculus, inarticulatus, inanis, ochroleucos; ramis divaricatis: apicibus furcatis, nigris." Ehrh. Beitrage zur Naturkunde, **3**: 82. 1788.

FIGURE: Hoffm. Descript. adum. Lich. *pl. 26. f. 2,* and *pl. 68. f. 5–7.*

Sowerby, Eng. Bot. **33**: *pl. 2374.* 1812.

DIAGNOSIS: *Thallus erect,* Cladoniform, branches rigid, apices *blackening.*

DESCRIPTION: *Thallus* erect, Cladoniform, rigid, often sulciform or foveolate, branches subterete, proximal portions virescent to stramineous, apices blackening; *cortex* glabrous, dull, papillate or striate; *primary branches* dichotomous, fruticulose (max. length 15 cm.); *secondary branches* dichotomous; *fibrils* entangled, frutescent, ramulous, apices furcate. *Apothecia* subterminal or lateral, rare, large (max. diam. 8 mm.), concave or applanate, at length convex, innate-marginate, margin disappearing and lacerate, disk chestnut. *Spores* 18–48 × 13–28μ.

CONTINGENT PHASES: (*a*) concolorous, divaricate (?f. *tenuior* Crom. Jour. Bot. **10**: (1) 232. 1872).

SUBSTRATA: On the earth.

GEOGRAPHICAL DISTRIBUTION: Confined to the Boreal zone. It has been reported from Maine (*Eckfeldt*), Quebec (*Macoun*),

Newfoundland (*Eckfeldt, Macoun, Arnold*), Labrador (*Eckfeldt, Macoun*), and Greenland (*Stizenberger, Macoun*) on the east coast, and from Vancouver (*Macoun*) to Alaska (*Cummings*) on the Pacific. In the interior it has been recorded from Great Bear Lake (*Leighton*), and I have seen specimens from the Yukon, Baffin land, Hudson bay and Hudson strait, Quebec and Keewatin. It has also been reported from Mt. Orizaba, Mexico, by Nylander. The Maine record seems in view of its range somewhat doubtful.

OBSERVATIONS: This plant has been cited both as *Alectoria ochroleuca* and *Alectoria ochroleuca rigida* (Vill.) Fr. The names are, however, synonymous, the former having priority. I have not seen a fertile example from our area, though fruited European specimens are not uncommon. It is easily distinguished by its erect growth,—suggesting slightly *Cladonia rangiferina* (L.) Web. The name *ochroleuca* has so long stood, as in the case of *jubata* and *barbata,* for a sectional rather than a specific concept, that even in as recent a work as Miss Cummings' "Lichens of Alaska" it is cited as well as the variety *rigida,* following the Tuckerman arrangement. Miss Cummings' key distinction limited the concolorous plants to *ochroleuca,* those "blackening at the tips" to the var. *rigida.* The original description of *ochroleuca,* however, reads "apice furcatis, nigris," and it seems that only the younger plants are concolorous.

SPECIMENS EXAMINED

LABRADOR: Black bay, *W. Palmer,* Aug. 5–6, 1887 (NY, NH); Battle harbor, *A. C. Waghorne,* Aug. 25, 1891 (CEC); Forteau, *A. C. Waghorne* (NH); *A. P. Low,* July 18, 1896 (NH); Clearwater Lake, *A. P. Low,* July 12, 1896 (CGS). QUEBEC: Shickshock mts., Gaspe, Aug. 26, 1882 (CGS). KEEWATIN: *T. W. Tyrrell,* July 28, 1893 (CGS). UNGAVA: Hudson bay, *A. P. Low,* Aug. 20, 1904 (4905 F); Mansfield island, *Dr. Bell,* Nov. 7, 1885 (1278 CM); Hudson strait, *R. Bell,* July, 1897 (CGS); Nottingham island, *R. Bell,* 1884 (CGS); Cape Chudleigh, *R. Bell,* Aug. 8, 1884 (CGS); Hudson bay, *A. P. Low,* Aug. 20, 1904 (CGS). GREENLAND: Pt. Foulke, *I. I. Hayes,* 1861 (ANS); *Holboll* (NY); Auk pen., *W. H. Burk,* 1891 (1812 H). FRANK-

LIN: Baffin land, *Dr. Lyall,* Aug., 1854 (1865 H). ALASKA: Unalaska, June, 1899 (CEC); Prince William sound, *F. V. Coville,* June 24, 1899 (CEC); Kadiak island, *W. Trelease,* July 2, 1899 (CEC); St. Michaels, *C. Wright,* 1880 (ANS, NH); *W. H. Dall,* 1874 (ANS); *W. H. Dall,* 1874 (NH); Unalaska, *W. A. Setchell,* June, 1899 (CEC); St. Michaels, *W. A. Setchell,* July 19, 1899 (CEC); St. Michael's island, *L. M. Turner,* Sept., 1875 (CEC). YUKON: *I. C. Russell,* July 28, 1889 (NH); near Dawson, *R. S. Williams,* Apr. 2, 1899 (1861 H). BRITISH NORTH AMERICA: *Drummond* (TH). ARCTIC OCEAN: *Franklin's* 1st Voyage (TH); Koby sound, *Beechy* (TH).

ALECTORIA OCHROLEUCA CINCINNATI (Fr.) Nyl. Synop. 282. 1858–60

Evernia ochroleuca cincinnati Fr. l. c.

TYPE: not indicated; the specimen on which the species is based is not preserved at Upsala, where all Fries' collections are, fide *Prof. O. Juel.*

TYPE LOCALITY: not indicated.

ORIGINAL DESCRIPTION: "thallo sarmentoso complicato rigidulo ochroleuco, apices concoloribus," Fries, Lich. Eur. reform. 22. 1831.

FIGURE: Sowerby, Eng. Bot. **29**: *pl. 2040.* 1809(?).

Hornem, Fl. Dan. **11**: *pl. 1897. f. 1.* 1828.

DIAGNOSIS: *Thallus prostrate, rigid,* subterete, *foveolate* or *cavernous, virescent.*

DESCRIPTION: *Thallus* prostrate, rigid, branches terete to compressed, virescent, occasionally blackening; *cortex* glabrous, dull, papillate or striate, foveolate or cavernous; *primary branches* remotely dichotomous, subterete or compressed, tortulous, occasionally monstrous (max. length 35 cm.); *secondary branches* subremotely dichotomous, subterete, tortulous; *fibrils* rare, subcapillaceous, terete. *Apothecia* rare, as in *sarmentosa. Spores* as in *ochroleuca.*

CONTINGENT PHASES: (*a*) clothed more or less with short (2 mm.) spines.

SUBSTRATA: On the earth and rocks.

GEOGRAPHICAL DISTRIBUTION: Confined to the Boreal zone. It has been reported from the White mts. (*Tuckerman*) to Green-

land (*Hue, Stizenberger, Macoun*) on the east coast. On the west coast from Oregon (*Stizenberger*) to Alaska (*Macoun, Cummings*). Other stations are: Washington (*Roell*), Quebec (*Macoun*), Newfoundland (*Tuckerman, Macoun, Eckfeldt, Stizenberger, Arnold*), Hudson bay (*Macoun*), Miquelon island (*Stizenberger*), Davis strait (*Stizenberger*), Labrador (*Arnold*), and Ungava.

OBSERVATIONS: That this variety is little understood by most students, is evidenced by the varied examples referred to it in herbaria. The fact that it has been called both a variety of the erect *ochroleuca* and the pendulous *sarmentosa* shows also that its classification has been difficult. This condition of affairs is not to be wondered at as Fries' original description if taken alone is not at all diagnostic, nor does it mention what has long been accepted as its most diagnostic feature, *i. e.,* a foveolate thallus. The loss of the type may have also aided in the dilemma. It is unquestionable that Tuckerman, a close follower of Fries, properly understood the plant, and he used the four diagnostic terms: "prostrate," "rigid," "dilated," "lacunose." Nylander also called it "prostrato," "compresso crassiore," "magis lacunoso vel lacunis." Th. Fries "prostratus," "rigidulus," "scobiculato-foveolatus." As Fries placed it between his "fruticuloso" *ochroleuca* and his "pendulo" *sarmentosa;* and as it seems to be a transitional variety spanning the gap between the reduced, caespitose, boreal *ochroleuca* and the more luxuriant, pendulous, subboreal *sarmentosa* it should be naturally considered a variety of the former, the first of the three plants described. Moreover *sarmentosa* and *cincinnati* show absolutely no intergradation where their ranges meet.

NOTE: *Alectoria luteola* DeN. ex Del. Giorn. Bot. 2: Pl. I, Tom. I. 206. 1846. Reported from Newfoundland by Stizenberger, l. c. 125, and originally described as follows:

"*Alectoria luteola* Delis, herb!

"*Evernia luteola* Montagn. herb!

"Trovasi a Terra nuova nell' America settentrionale, secondi esem plari del chiarissimo Montagne, e dell' erbario dello stesso Delise favoritimi dall'illustre Lenormand,

"Tallo filiforme lunghissimo di color giallo pallido, levigato,

tenace, semitrasparente; rami di dicotomia in dicotomia assottigliati, gli ultimi capillari. Apoteci laterali, sessili, orbicolari od allungati, piano-convessi, di due millimetri di diametro, di color fosco nereggiante nel disco. Sporidii ellittico-rotondati di tre in quattro centimillimetri di lunghezza, di color castagno fosco, quasi visibili ad occhio nudo."

SPECIMENS EXAMINED

LABRADOR: Fox Harbor, *A. C. Waghorne,* Sept. 16, 1891 (NY); Black Bay, *W. Palmer,* Aug. 5, 1887 (NY). UNGAVA: Diggs island, *R. Bell,* 1885 (CGS). GREENLAND: (NY). ALASKA: Unalaska, *W. A. Setchell,* June, 1899 (CEC); Unalaska, *J. H. Bean,* Oct. 1, 1880 (NH); Cape Nome, *W. A. Setchell,* July, 1899 (NH).

ALECTORIA OSTEINA Nyl. Flora l. c.

Alectoria ochroleuca f. *osteina* Nyl. Synop. l. c.

TYPE: No. 6947, coll. Galeotti.

TYPE LOCALITY: Mt. "Orizaba, altit. 10,000 ped.," Mexico.

ORIGINAL DESCRIPTION: "sistere meam *A. osteinam Cornicularia laeta* Tayl. . . ., *C. lata* Tayl. . . . ; sed nil neque laetum, neque latum habet haec species," Flora **41**: 378. 1858.

"Variat dein forma minore *osteina* Nyl. . . . thallo magis albido," Synop. 282. 1858–60.

DIAGNOSIS: *Thallus erect,* pale *virescent,* branches rigid *slender,* subterete, and *Cladoniform.*

DESCRIPTION: *Thallus* erect, rigid, subterete, *Cladoniform, pale* virescent; *cortex* glabrous, dull, striate; *primary branches* subterete, slender, dichotomous (max. length 6 cm.); *secondary branches* terete, slender, dichotomous; *fibrils* terete, minutely slender, furcate. *Apothecia* small (max. diam. 1.5 mm.), concave, innate, margins entire, incurved, disk chestnut to dark brown. *Spores* as in *ochroleuca.*

SUBSTRATA: on the earth.

GEOGRAPHICAL DISTRIBUTION: Mexico, Mt. Orizaba and Toluka (*Stizenberger*).

OBSERVATIONS: This plant appears to be a reduced slender, alpine form otherwise strongly resembling *ochroleuca,* of which by Nylander himself it was once considered a form. I have only been able to examine one authentic specimen (TH) from our

area, and am therefore unable to give it sufficient study to add anything to its history. The apices of the branches of the specimen examined are punctate with dark spermogones.

ALECTORIA SARMENTOSA (Ach.) Lich. Univ. 595. 1810

Lichen sarmentosus Ach. l. c.

TYPE: not indicated, but the specimen on which the species was based is in the Acharian herbarium at Helsingfors, fide *Elfring*.

TYPE LOCALITY: "Bjorko, Roningaholm &c. Somalandiae."

ORIGINAL DESCRIPTION: "filamentosus, nudus, diffusus, dichotomus, fistulosus, lacunosus; loris sarmentosis, apice ramosissimis, capillaceis implexis," Ach. Kong. Vet. Act. Nya Handl. **16**: 212. 1795.

FIGURE: [Dill. Hist. Musc. *pl. 13. f. 15.* 1841.]

Ach. l. c. *pl. 8. f. 2.*

Hoffm. Descript. adum. Lich. *pl. 72. f. 1–3.* 1801.

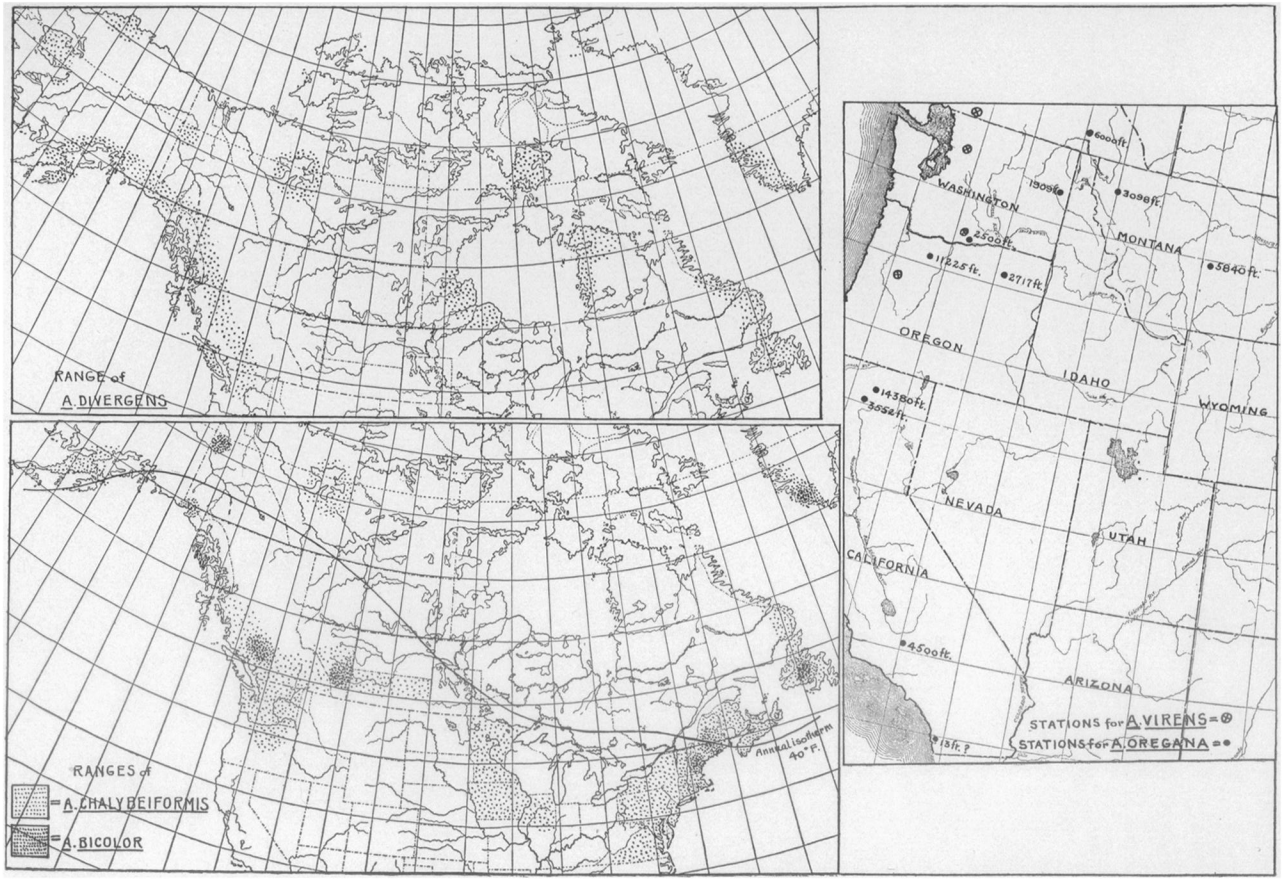
DIAGNOSIS: *Thallus pendulous,* pliant, subterete, glabrous, *stramineous* to *virescent.*

DESCRIPTION: *Thallus* pendulous, pliant, branches terete to compressed, stramineous to virescent, occasionally blackening; *cortex* glabrous, dull, striate, often sulciform; *primary branches* remotely dichotomous, subterete to compressed, tortulous (max. length 45 cm.); *secondary branches* subremotely dichotomous, subterete, tortulous; *fibrils* capillaceous, terete. *Apothecia* not uncommon, medium (max. diam. 3 mm.) lateral, innate-marginate, margins disappearing, disk dark brown, chestnut or pale yellow. *Spores* as in *ochroleuca.*

CONTINGENT PHASES: (*a*) clothed more or less with short (2 mm.) spines.

SUBSTRATA: On trees, generally conifers.

GEOGRAPHICAL DISTRIBUTION: Confined to the upper Transition and lower Boreal zone. It has been recorded from New Hampshire (*Tuckerman*) to Greenland (*Macoun, Stizenberger*) on the Atlantic coast, though I have seen only reduced examples from as far north as Newfoundland. The intermediate records are Maine (*Eckfeldt*), Cape Breton (*Macoun*), Anticosti (*Macoun*), Newfoundland (*Eckfeldt, Arnold*), Labrador (*Eckfeldt, Macoun, Cummings*). Dr. Eckfeldt has also recorded it from New Jersey,



MAPS SHOWING DISTRIBUTION

but this would be an isolated, unusual, and it would seem doubtful locality. On the Pacific coast it has been recorded from Oregon (*Tuckerman*) to Alaska (*Cummings, Macoun*). Other Pacific coast records are Washington (*Tuckerman*), British Columbia (*Macoun*) and Sitka (*Rothcock*). In addition to these localities I have examined specimens from New Brunswick, Miquelon island in the east; from Mexico, Mt. Oaxaca, Mt. Orizaba, northern California, Idaho, Montana, Saskatchewan, Alberta and Yukon in the west.

OBSERVATIONS: Either Acharius' *sarmentosa* or Hoffmann's *dichotoma* are applicable to this plant, as both names were given to it in the year 1795. As *sarmentosa* has long stood, it seems, however, advisable as a nomina conservanda to always consider *dichotoma* a synonym. An examination of the original descriptions and figures will show that Acharius evidently had in his possession a more sulciform specimen than Hoffmann. Wainio in his report on the Hoffmann herbarium called the German plant = to Acharius' *sarmentosa*. The rigidity of the thallus is not a particularly good character for separation from the foregoing variety, nor are the branches terete in one and in the other compressed. The subboreal, pendulous, tree growing species, either stramineous, virescent or occasionally blackened does not intergrade into the boreal, prostrate, *cavernous,* earth growing, always virescent variety of the former species.

NOTE: *Alectoria crinalis* Ach. Lich. Univ. 594. 1810. This form has been recorded from Labrador and Newfoundland by Arnold (Lich. Fragm. l. c. 1894–1896). This seems to represent a tangled, filiform phase of the above species. It was described as follows: "thallo subcompresso ramosissimo cinerascente fragilissimo, lorulis filiformibus superne teretiusculis; apotheciis? convexis fuscis." Suecia.

SPECIMENS EXAMINED

MAINE: Blanchard, *F. S. Blake,* Jan., 1909 (1122, 1112 H); NEW BRUNSWICK: Grand Manan, *H. Willey,* 1879 (NH). NOVA SCOTIA: Port Mulgrave, *Barclay* (TH); Baddeck, *Macoun,* July 28, 1898 (CGS). ANTICOSTI: Salt Lake, *Macoun,* Aug. 10,

1883 (CGS). NEWFOUNDLAND: Miquelon island, *E. Delamare* (NY); *S. Dennis,* Mar. 13, 1863 (TH); Leading Tickle, *A. C. Waghorne,* May 11, 1893 (NY, CEC, CGS); Notre Dame bay, *A. C. Waghorne,* Oct. 5, 1893 (NY); Shoal harbor, *A. C. Waghorne,* Dec. 18, 1891 (1278 CM); Notre Dame bay, *A. C. Waghorne,* Jan. 5, 1893 (NY); Bay of Islands, *C. D. Howe,* Aug. 10, 1901 (1873 H); *A. C. Waghorne,* Apr. 4, 1894 (CEC). MEXICO: Mt. Oaxaca, 9,000 ft., *C. G. Pringle,* June 3, 1894 (R). CALIFORNIA: *E. J. Spence* (ANS); Sisson, *M. A. Howe,* July 24, 1894 (NY, NH). OREGON: Mt. Hood, *A. S. Foster,* June 20, 1907 (459 SMC); Cascade mts., *C. G. Pringle* (S, CEC); Sanvier's island, *J. Howell* (S); Wallowa mts., 5,100 ft., *E. P. Sheldon,* Sept. 21, 1897 (NH); *E. Hall,* 1871 (NH); Coast Range, *A. R. Sweetzer,* July 18, 1899 (NH); Mt. Hood, 3,000 ft., *T. C. Frye,* Aug. 28, 1907 (4833 F); Wallowa mts., 5,100 ft., *E. P. Sheldon,* Sept. 29, 1897 (W); Cascade mts., *C. G. Pringle,* Sept. 22, 1881 (W); Three Sister mts., *L. H. Mills,* Aug., 1910 (1931 H); Mt. Hood, 3,000 ft., *A. S. Foster,* June 20, 1907 (401 H); Carlton, 500 ft., *L. H. Mills,* 1909 phase (*a*) (1641 H); Mt. Hood, *J. W. Eckfeldt,* 1880 (CGS). WASHINGTON: Liberty creek, *T. A. Bonser,* May, 1908 (731 SMC); Colville region, *W. M. Cranby* (ANS); Mt. Ranier, *C. A. Mosier,* 1892 (NH); Olympic mts., 5,000 ft., *T. C. Frye,* Aug. 14, 1907 (4784 F); *W. W. Calkins* (3009 CM, 985 F); Mt. Ranier, 5,000 ft., *T. E. Frye* (4764 F). IDAHO: Priest lake, 1,800 ft., *D. T. MacDougal,* July 27, 1900 (NY); Lake Pend d'Orielle, *J. B. Leiberg,* 1890 (NY); Chilco pass, Kootnai Co., 4,000 ft., *J. B. Leiberg,* 1889 (ANS); *G. E. Tower,* 1902, no. 13 Lich. Exs. Merrill (1825 H); *J. B. Leiberg* (NH); Hayden lake, 2,200 ft., *T. K. Richards,* Aug. 10, 1909 (1613 H); Coeur d'Alene river, 4,000 ft., *T. K. Richards,* Aug. 16, 1909 (1612 H). MONTANA: Sin-Yah-a-min lake, 3,000 ft., *W. P. Harris,* June 21, 1901 (9 SMC, NY); Long ridge, 6,150 ft., *W. P. Harris,* July 10, 1901 (10 SMC, NY); *F. L. Liser,* Aug. 18, 1893 (NH). BRITISH COLUMBIA: Lake Nipigon, *J. Macoun,* 1884 (NY, CEC); Queen Charlotte island, *Tracy Boas,* 1901 (NY); Emerald lake, 4,300 ft., *H. Patterson,* June 30, 1894 (NH, CM); Glacier, Mt. Fairview, 5,000

ft., *B. Fink,* Aug., 1906 (5867, 5870, 5913 F); Yoho pass, *J. Macoun,* Aug. 6, 1904 (4879 F); Revelstoke, 2,000 ft., *C. E. Shaw,* July 9, 1905 (3563 CM); Puget sound, Mt. Constitution, *B. Fink,* July 13, 1906 (5581, 5547, 5498 F; 1544, 1895 H); Turtle Back mt., *B. Fink,* July 30, 1906 (5425 F); Glacier, *B. Dean,* June, 1896 (NY); *W. W. Calkins* (W); Vancouver island, *W. Trelease,* June 2, 1899 (CEC); *Hossack,* 1909 (2006 H); New Westminster, *A. J. Hill,* 1906 (1547 H); (?) 100 ft., *L. H. Mills,* Sept. 1, 1909 (1687 H); Barclay sound, *J. Macoun,* 1909 (1777 H); Columbia valley, *J. Macoun* (970 H); Friday harbor, *B. Fink,* July 7, 1906 (1060 H); Donald, *Macoun,* July 6, 1885 (CGS); Selkirk mts., *Macoun,* Aug. 8, 1890 (CGS); Vancouver island, *Macoun,* Apr. 30, 1887 (CGS); Skeena river, *J. M. Macoun,* Oct. 2, 1891 (CGS); Revelstoke, *Macoun,* May 5, 1890 (CGS); Yoho pass, Sept. 8, 1904 (CGS); Burrard inlet, *Macoun,* Apr. 24, 1889 (CGS); McLeod's lake, June 27, 1875 (CGS). ALBERTA: Laggan, 5,000 ft., *C. Crosby,* July 22, 1901 (5912 F); Rocky mts., 6,000 ft., *G. Martin* (1805 H); Kicking Horse pass, *Macoun,* Sept. 13, 1884 (CGS). SASKATCHEWAN: Moose mt., 6,000 ft., *J. Macoun,* June 30, 1897 (CGS). ALASKA: Unalaska, *W. A. Setchell,* June, 1899 (CEC); Indian river, Sitka, *G. E. Cooley,* Aug. 12, 1891 (NY); Skeena, *J. Macoun,* Oct. 2, 1891 (ANS); Prince William sound, *A. W. Greeley,* Aug., 1902 (NH); Prince William sound, *C. W. Hayes,* Sept., 1891 (W. CEC); Indian river, *G. E. Cooley,* Aug. 12, 1891 (W); Sitka, *L. J. Cole,* June 15, 1899 (CEC); New Metlakahtla, *W. Trelease,* June 4, 1899 (CEC); Yakutat bay, *W. Trelease,* June 22, 1899 (CEC); Sheep creek, *G. E. Cooley,* Aug. 5, 1891 (CEC); *F. V. Coville,* June 5, 1899 (CEC); Port Etches, *J. M. Macoun,* June 18, 1892 (CGS). YUKON: Chilcoot pass, *R. S. Williams,* Apr. 6, 1898 (1859 H).

ALECTORIA VIRENS Tayl.* l. c.

Alectoria tortuosa Merrill, Bryologist, **12**: 5. 1909.

TYPE: In the Taylor herbarium, Boston Society of Natural History, Boston, Massachusetts.

* Müll. Arg. **74**: 373. 1891 "Ex omni analogia et naturali affinitate congenerica esse debet cum *A. ochroleuca.*"

TYPE LOCALITY: Sheopore, East Indies, Wallick, January, 1821.

ORIGINAL DESCRIPTION: "thallo pendulo, elongato, filiformi, tereti-compresso, subdichotomo, implexo, pallide virenti, hinc canaliculato, ad angulos compresso, ramulis ultimis setaceis, flexuoso-curvatis, apice nigricantibus; gemmis in thalli canaliculo pulveraceis, concoloribus; apotheciis minutis, convexis, fuscis, immarginatis," Hook. Jour. Bot. **6**: 188. 1847.

DIAGNOSIS: *Thallus pendulous,* pliant, *sulpho-virescent,* branches subterete, dull, *tortulous.*

DESCRIPTION: *Thallus* pendulous, pliant, branches subterete to compressed, tortulous, sulpho-virescent (more or less washed with brown); *cortex* dull, sparingly striate (in the type longitudinally split); *primary branches* subremotely dichotomous, more or less tortulous (max. length 20 cm.); *secondary branches* dichotomous, somewhat tortulous; *fibrils* capillaceous, terete. *Apothecia* not observed.

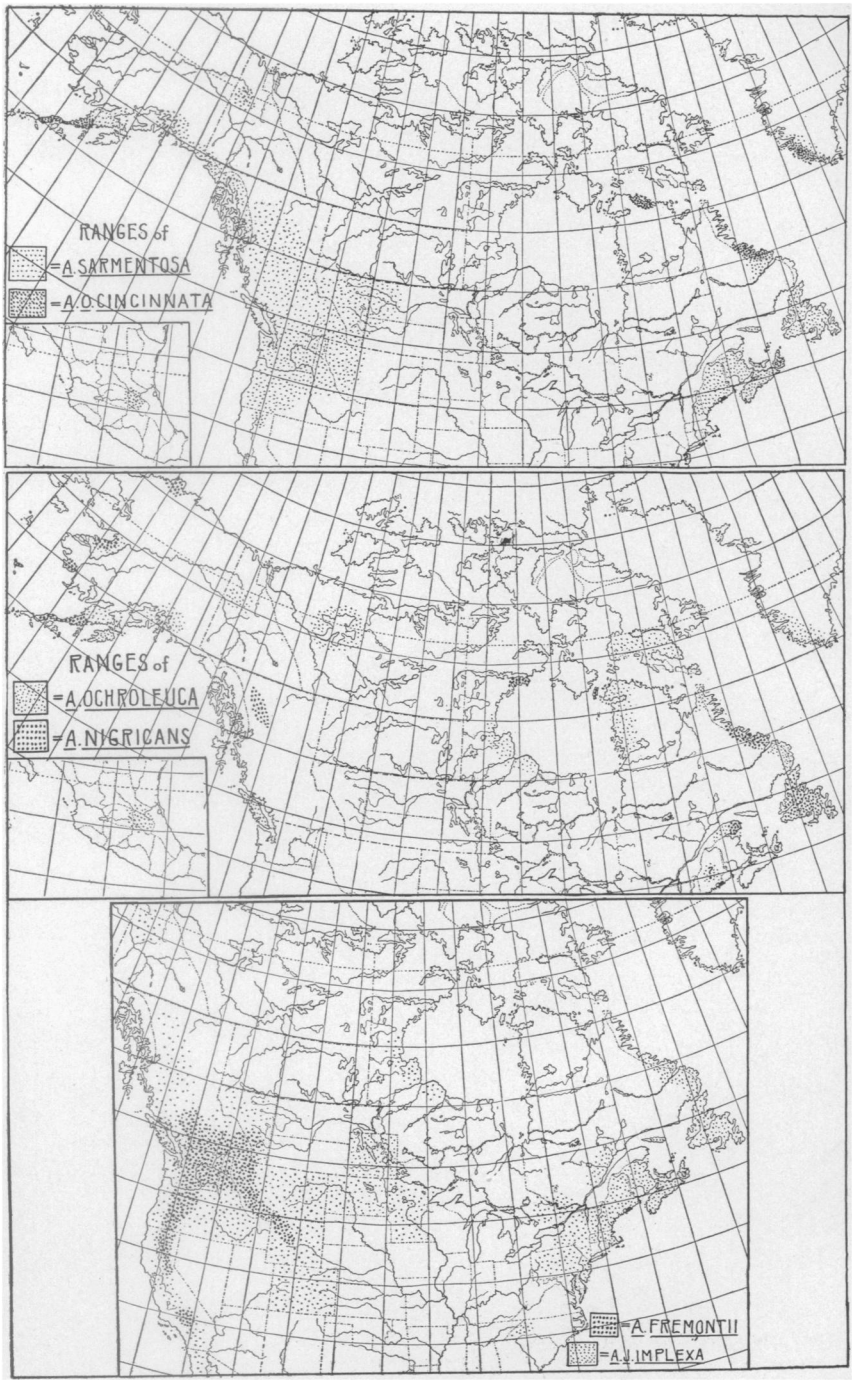
SUBSTRATA: On trees.

GEOGRAPHICAL DISTRIBUTION: Shores and islands of the strait of Georgia, British Columbia and Puget sound, Washington; also atypical examples examined from Silverton, Oregon, and Goldendale, Washington.

OBSERVATIONS: This plant is poorly represented in our area. Though Taylor's original description included the apothecia, the type is sterile, and according to Hue the apothecia are unknown. Mr. G. K. Merrill described our virescent examples as belonging to a new species, differentiating it from *virens* on the ground of its tortulous branches. As a tortulous condition is characteristic of a number of the pendulous *Alectorias,* as well as being true of the type of *virens,* our examples, if recognized as distinct, must be referred to this species of Taylor with which they are closely comparable. Seeming intergrades, however, occur with *jubata* through *implexa,* and only more material not now available can decide its true relationship. I cannot help doubting in this light Müller's attributed affinity.

SPECIMENS EXAMINED

OREGON: Silverton, *A. S. Foster,* Apr. 5, 1910 (NH). WASHINGTON: Goldendale, *A. S. Foster,* Dec. 20, 1909 (940 SMC); Friday harbor, *B. Fink,* June 28, 1906 (5487 F; 1252, 1543 H).



MAPS SHOWING DISTRIBUTION

I have excluded from this genus *Oropogon Loxensis* (Fée) Th. Fr. as have recent authors on the ground of its distinctive spore differences. This monospecific genus will be treated in a later paper.

In concluding this study I have many persons to thank, not only for the loan of material, but for much assistance in the examination of literature. For the most part they have been those persons who have helped in the past in the preparation of my papers on the *Usneas* and *Evernias,* and without whose ready help the completion of these studies would have been impossible.

THOREAU MUSEUM NATURAL HISTORY,
CONCORD, MASSACHUSETTS.

EXPLANATION OF PLATE 41

1. *Cetraria californica* Tuck. Specimen in the U. S. National Herbarium. × ⅔.

2. *Cetraria californica sepincola* R. H. Howe, Jr., ex Tuck. Specimen in the U. S. National Herbarium. × ⅔.

3. *Alectoria osteina* Nyl. Specimen Taylor Herbarium, Boston Society Natural History, from Mexico. × ⅔.

4. *Alectoria bicolor* (Ehrh.) Nyl. Specimen No. 1861, Author's herbarium from Yukon. × ⅔.

5. *Cetraria californica* Tuck., reduced condition. Specimen in the U. S. National Herbarium. × ⅔.

EXPLANATION OF PLATE 42

1. *Alectoria chalybeiformis* (L.) Gray. Specimen in the herbarium of the Boston Society Natural History. Slightly reduced.

2. *Alectoria divergens* (Ach.) Nyl. Specimen in the Taylor Herbarium, Boston Society Natural History. × ½.

3. *Alectoria Fremontii* Tuck. Specimen (cotype) in the Taylor Herbarium, Boston Society Natural History. × ½.

4. *Alectoria jubata implexa* (Hoffm.) Ach. Specimen in the herbarium of Dr. L. W. Riddle, Wellesley, Mass. × ½.

EXPLANATION OF PLATE 43

1. *Alectoria sarmentosa* (Ach.). Specimen in the herbarium of Wellesley College. × ½.

2. *Alectoria virens* Tayl. Type specimen in the Taylor Herbarium, Boston Society Natural History. × ½.

3. *Alectoria oregana* Nyl. ex Tuck. Specimen in the Sprague Herbarium, Boston Society Natural History. × ½.

4, 5. *Alectoria oregana* Nyl. ex Tuck. Specimens (cotypes) in the Sprague Herbarium. × ½.

EXPLANATION OF PLATE 44

1. *Alectoria ochroleuca cincinnati* (Fr.) Nyl. Specimen in the herbarium of the New York Botanical Garden. × 1.

2. *Alectoria nigricans* (Ach.) Nyl. from St. Michael's island, Alaska. Specimen in the herbarium of C. E. Cummings, Wellesley College. × ⅔.

3. *Alectoria ochroleuca* (Ehrh.) Nyl. from St. Michael's island, Alaska. Specimen in the herbarium of C. E. Cummings, Wellesley College, × ⅔.

4. *Alectoria ochroleuca* (Ehrh.) Nyl. showing apothecia. Specimen from Norway in the National Herbarium. × 1.

5. Apothecia of *Alectoria Fremontii* Tuck. much enlarged.

6. Apothecia of *Alectoria sarmentosa* (Ach.) much enlarged.

7. Apothecia of *Alectoria oregana* Nyl. ex Tuck. much enlarged.

EXPLANATION OF PLATE 45

1. Type of *Alectoria divergens* (Ach.) Nyl. in the Acharian Herbarium. × 1.

2. Type of *Alectoria sarmentosa* (Ach.) in the Acharian Herbarium. × 1.

3. Type of *Alectoria nigricans* (Ach.) Nyl. in the Acharian Herbarium. × 1.

4. Acharian plate of *Lichen sarmentosa,* evidently drawn from type specimen. × 1.

5. Dillenian plate of *Usnea jubata* on which Linnaeus based his species *Lichen jubatus.* × 1.